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- 5 & 6. Differential reactions to taste and temperature stimuli in newborn infants—K. JENSEN

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SOME ASPECTS OF MEMORIES AND AMBITIONS IN CENTENARIANS*¹

Cushing Hospital, Framingham, Massachusetts

PAUL COSTA² AND ROBERT KASTENBAUM

Well, this is a time for introspection, to take inventory of himself, to evaluate the mistakes made and opportunities lost, to recognize and appreciate the many virtues of others that had been overlooked. It is also a time for retrospection, and here begins the real second childhood. Too many this is a comforting and rewarding period. He now begins to relive his life backward. He is astonished to see so much beauty in nature, and also in people, he has by-passed. He finds it more difficult to recall quite recent incidents than those which occurred further back, that the farther he goes the better his memory becomes until he reaches early childhood when everything becomes clearly bright.

The unedited passage above is from the essay "Second Childhood" written by Mr. Albert Davis, age 100, in August, 1959. He died in March, 1963, at the age of 104.

A. BACKGROUND

Relatively little psychological research has been done with centenarians, yet the long period of time during which the centenarian has been developing and functioning offers a truly unique opportunity to study the processes by which a person organizes his total life experiences.

At present there are few theoretical positions available to the interested practitioner or researcher in gerontology. What are the theoretical and applied implications of very advanced age? How does the centenarian integrate his extensive past experiences with his present moment of existence? What does the present mean to him, and how does he conceive of futurity? Does the centenarian plan ahead or does he organize his life on a day-by-day basis?

* Received in the Editorial Office, Provincetown, Massachusetts, on October 11, 1966, and given prior publication in accordance with our policy regarding manuscripts on the subject of aging. Copyright, 1967, by The Journal Press.

¹ This study is part of a larger project supported in part by USPHS Grant MHO-1520 at Cushing Hospital, Framingham, Mass. The authors are grateful to the Social Security Administration for making its centenarian data available for their analysis. William McKenna, now of Antioch College, participated in the early stages of the analysis. A preliminary version of this paper was presented at the 1965 meetings of The Gerontological Society (Los Angeles, California).

² Now a graduate student in the Human Development Program, University of Chicago, Chicago, Illinois.

This study attempts to explore some of these issues, a few of which were expressed in the "Second Childhood" essay by Mr. Davis. The present exploratory approach is at the level of verbal self-reports, with complete dependence upon interview data. Analysis will focus on the responses to three memory items, and one item concerning future outlook.

This paper reports an analysis of centenarian interviews that were devised and conducted by the Social Security Administration for people 100 years old or over who were on the benefit rolls as of 1963. The S.S.A. dispatched field representatives from district offices throughout the country to gather material for the four-volume publication: *America's Centenarians: Reports of interviews with Social Security beneficiaries who have lived to 100*. The interviews followed a standard 22-question outline, and the material gathered by the field representatives was reproduced in *America's Centenarians*, in most instances in the centenarians' own words. The above publication consists entirely of raw interview data, without analysis or interpretation. Because all information in S.S.A. records is confidential, only the stories of those who consented to the publication of this information have been included. Some centenarians, or their families, did not wish publicity because of delicate health or other personal reasons.

The interview items were age at time of interview, sex, place of birth, marital status, number of children, number of grandchildren, number of great-grandchildren, participation in armed services, earliest memory, most salient historical event remembered, most exciting event remembered, presidents remembers having voted for, nature of first job, nature of the work done most of life, thoughts about the Social Security program (in general), part of income played by Social Security checks, thoughts about the Social Security program (personal), current health, reason for longevity, church participation, current use of time, and future ambitions.³

There are two major limitations within the data. One limitation is the possible bias of the published centenarian interviews. It appears that the protocols that comprise the sample favor the healthier and more intact centenarians. The other limitation is the fact that the theoretical framework (developmental-field) was applied after the interviewing had been conducted. An interview schedule designed with a definite theoretical perspective would have yielded additional data of scientific interest. One important specific would have been a measure of the transaction between the interviewer and S, which

³ Some of the items were analyzed, but not included in the present report. In several cases the same general item was analyzed in terms of multiple coding categories. Copies of the detailed coding categories and information about responses not reported here may be obtained from the authors.

is an essential level of analysis in developmental-field theory. Despite the methodological limitations of the data, the authors are grateful to the S.S.A. for permission to utilize their information.

B. CHARACTERISTICS OF THE SAMPLE

The dates of the interviews encompass the 1958-1962 period, with the majority of the interviews conducted during 1959-1960. More than half of the sample were alive at the time these reports were published. The following facts were true of the sample as of 1963. The sample reported here is comprised of 276 centenarians, 90 per cent of whom were between 100 and 103 years of age when interviewed. Men predominate (70 per cent). Of the Ss born in the United States, most come from the Midwest, 43 per cent; 24 per cent from the Northeast; 23 per cent from the South and Southwest; and 10 per cent from the Far West. An additional 34 or 12 per cent of the total sample were born in Europe. Four-fifths of the sample were interviewed in a place different from their birth place.

With respect to marital status, 75 per cent of the total sample were widowed, most having been married only once; some 20 per cent of the widowed were multiple widows or widowers. Fourteen per cent were married with their first or second spouse still alive. The divorce rate was very low, less than 1 per cent. The number of single people was less than 3 per cent. Only 14 per cent had no children. Approximately three-fourths of the Ss had grandchildren and great-grandchildren. The overwhelming majority of the centenarians (90 per cent) were able to dress and feed themselves, and maintain personal hygiene. Most of the centenarians (91 per cent) reported some degree of current social contact. Eighteen per cent remained active churchgoers.

C. RESULTS

1. *Temporal Location of Memories*

To explore the psychological structure of centenarians, the authors focused upon limited aspects of their time perspective. The guidelines of the present theoretical orientation are those of Kastenbaum's developmental-field approach (4, 5), which places strong emphasis on time perspective research.

One possible measure of the centenarian's perspective is the time period in life in which he locates his memories. The location in time of the available three recall items may not only delineate the degree of extension into the past, but also indicate which periods of life are most salient to the person, now at age 100.

The three memory recall items were (a) the Earliest Memory (EM), (b) the Most Salient Historical Event (MSH), and (c) the Most Exciting Event (ME). The categories used in locating the time periods for the three recall items were Early Childhood, ages 0 to 5; Childhood, ages 6 to 12; Adolescence, ages 13 to 19; Young Adult, 20 to 39; Middle Age, 40 to 70; and Old Age, over 70.

First, it is interesting to note that the percentage of centenarians responding varies considerably among the three recall items. The highest percentage of the sample responding is for the "Earliest Thing Remembered" (88 per cent); 56 per cent respond for the "Most Exciting Event," and 48 per cent for the "Most Salient Historical Event" (see Table 1). The earliest events were recalled more often than the Most Exciting or the Most Salient Historical Event.

The analysis of the distribution of time periods for the three recall items excludes those Ss who either did not answer or did not localize the event in time. Thus, the percentages given for each of the time periods are based on differing sample sizes for the three recall events.

The distribution of time periods for the earliest memory (EM) is markedly skewed toward the early years of life. Early Childhood is most frequently cited for the time period of the EM (58 per cent of sample, $N = 187$). Ninety-two per cent of the EM fall within the first 12 years of life.

For the MSH event the distribution of time periods is multimodal with the greater percentage of historical events (49 per cent, $N = 123$) falling within the first two time periods, 0 to 5 years (27 per cent) and 6 to 12 years (22 per cent). The second mode includes the time periods 20 to 39 years (23 per cent) and 40 to 70 years (19 per cent). The distribution of time periods for the ME event is skewed toward the higher ages or time periods. The time period most frequently cited is Young Adult with 34 per cent of the sample ($N = 118$). Thus, Early Childhood and Childhood times are most salient in terms of the centenarians' EM. Early Childhood, Young Adult, and Middle Age are most often cited in terms of the MSH event. For the ME event, the period of Young Adulthood is most salient.

As might have been expected, the EM was almost always located within the first few years of life (ages 0 to 12), with just a few cases in the Young Adult range and none in Middle Age. It is also understandable that the MSH was localized over a larger range, and with approximately the same frequency from time period to period. However, there was relatively little *a priori* basis for predicting the distribution of ME recollections. While the Young Adult period was most salient, as already noted, it is also worth bear-

ing in mind that approximately one-sixth of these centenarians reported their ME as occurring in Old Age (beyond 70).

It is also interesting to note the percentage of Ss citing Adolescence as a salient period in their past experience among all the recall items. Only 4 per cent of the Ss cited Adolescence as the time of the EM; 6 per cent cite Adolescence as the time of the MSH; while 14 per cent cite Adolescence as the time in which the ME occurred.

2. S's Relation to His Memories

In an attempt to measure the processes by which the centenarian locates himself within his own temporal experience, a set of coding categories was devised. These categories attempt to delineate the person's *relation* to the event recalled as distinct from the *content* of the event recalled. The relation to the event was dichotomized into (a) the degree of involvement the centenarians exhibit during the retelling of this memory and (b) the situational context of the memory.

The *engrossment-perspective* dimension is employed in coding the person's involvement in telling the event to the interviewer. If the person retells the event with vividness and great detail, then his relation to the event recalled is classified as engrossment. If the person seems to be retelling the event as an objective "thing" that he now sees as part of his past life, then S's relation to the event is classified as perspective. Engrossment in more general terms has been defined "... as complete psychological involvement in one unitary situation, while perspective may be regarded as simultaneous involvement at two or more points in the life-span. The quality of engrossment vanishes when we compare, judge, plan, or seek to explain" (3, p. 7).

In classifying the *situational* context of the memory, the authors employed two dimensions. The *observer-participant* dimension considers the S's relation to the event when it took place—was he an active agent or passive recipient? The private-public dimension concerned the event itself. Was the event shared with others, or was it of a solitary nature?

The distribution of the centenarians' relations to the recall items reveals that the categories of perspective, participant, and public (as contrasted with engrossed, passive, and private) are most frequently encountered in the total sample. The engrossment relation is approximately equal for ME (32 per cent, $N = 118$), and for EM (30 per cent, $N = 187$), but only 18 per cent ($N = 123$) for the MSH.

For EM, 45 per cent of the Ss report a private event, 26 per cent are private for the ME, and 4 per cent are private for the MSH. Ss have greatest

participation in the ME—69 per cent, as compared with 53 per cent for the EM and 12 per cent for the MSH.

Next, let us consider the *interaction* between the S's relation to the recall items and the distribution of the time periods cited for each of the recall items. For both EM and MSH there is a greater proportion of engrossments for the earliest time periods cited for the recalled events. In other words, where a comparison is made between the dimension of engrossment *vs.* perspective for the time period of the recollection, we find that the earlier the time period cited the higher the proportion of engrossments, and the later the time period in life cited for the event, the greater the proportion of perspectives (see Table 2).

Interestingly enough, Mr. Davis' notions about early childhood memories becoming clear, and memory being better for earlier events, are in harmony with the statistical findings. He appears to be correct also in believing that the earlier the age at which the episode is cited, the greater the degree of engrossment as contrasted with perspective.

3. *Unrealized Ambitions*

Future time perspective is a complex topic to investigate at any age level, requiring a broad range of carefully selected assessment procedures (2, 8). With only one futurity item available for analysis, the authors can do no more than gain a few hints as to the nature and meaning of future perspective for centenarians. The item was: "Do you have any unrealized ambitions?" (the final item in the schedule). The present analysis is concerned not only with the response to this item *per se*, but also with its relationship to the set of recall items.

Approximately two-thirds of the Ss answered the future ambition inquiry. These 192 respondents were almost equally divided with respect to presence or absence of a future ambition. Each of the subgroups can be subdivided again according to their attitudes toward future ambitions. Those who said they had no ambitions were about equally divided between centenarians who simply reported "no ambitions" and those who pointed out that they had satisfied their ambitions earlier in life and, thus, there was nothing further to be accomplished. Among those who reported future ambitions, again there was an approximately even split—52 per cent expressed ambitions that they considered unrealizable in their lifetime, while 48 per cent specified ambitions that they hoped to fulfill.

Those who seek improvements in material welfare for themselves, their family, or their immediate environment were more optimistic about their

ambitions being fulfilled than were those who referred either to restorative or self-development ambitions. The former were seen as capable of fulfillment within the centenarian's lifetime twice as frequently as were those ambitions that concern restoration or self-development (by restoration is meant the repossession of some lost value, either in terms of health or ways of functioning; self-development includes betterment in the intellectual, religious, and ethical spheres). The future ambition that was seen most optimistically was that of reaching a certain age. Twelve of the 13 Ss whose future ambition was solely to reach a certain age were optimistic or hopeful of fulfillment.

4. *Relationship Between Recall and Future Ambitions*

The following analysis is an attempt to apply theoretical principles to the *relationship* between the past and future outlooks of the centenarian Ss, although the limited nature of the data makes this a rudimentary effort.

An important characteristic of the structure of any system is degree of *differentiation*. "In broad psychological terms differentiation refers to the complexity of a system's structure. A less differentiated system is in a relatively homogeneous structural state; a more differentiated system is in a relatively heterogeneous state. . . . Among the major characteristics of the functioning of a highly differentiated system is specialization. When used to describe an individual's psychological system, specialization means a degree of separation of psychological areas, as feeling from perceiving, thinking from acting. It means as well, specificity in manner of functioning within an area" (7, p. 11). Thus, developmentally one can conceptualize the organization of centenarians' memories as a subsystem of a more general psychological system. Theoretically, the memory subsystem may vary from a minimal to an optimal degree of differentiation. One implication is that highly differentiated organizations imply a finer articulation, or separation, among past experiences. Parts of the "field" (of memories) are experienced as discrete and unique. A low level of differentiation implies a global or fused state of organization and functioning.

At the outset of this paper, the authors raised questions, such as "How does the centenarian integrate his extensive past experiences with his present moment of existence?" "How does he conceive of futurity?" and "Does the degree of differentiation and level of organization of the S's past experiences bear any relationship to his differentiation of future aspirations?" To assess the degree of differentiation of memories in the present sample, a scale was constructed based upon the number of significant memories recalled by each S. This corollary scale was dimensionalized by using as criterion recall of the

three significant memories: Earliest Memory (EM), Most Salient Historical Event (MSH), and Most Exciting Event (ME). For each *S*, recall of all three memories was Level 4; the recall of any two memories Level 3, etc. Level 1 represents the state of least differentiation as indicated by no recall. Inspection of Table 3 reveals that 34.4 per cent or 95 *S*s recalled two of

TABLE 3
COROLLARY SCALE OF DIFFERENTIATION OF MEMORIES
(*N* = 268)

Level	Number and kinds of items recalled	Total	% of sample	<i>N</i>
4	Recall all three	<i>f</i> = 82	30.8	82
3	Recall two events	<i>f</i> = 96	34.4	96
	Early-Exciting	<i>f</i> = 52 (54.7%)		
	Early-Historical	<i>f</i> = 34 (35.4%)		
	Exciting-Historical	<i>f</i> = 10 (9.9%)		
2	Recall one event	<i>f</i> = 55	22.1	55
	Early	<i>f</i> = 41 (77%)		
	Exciting	<i>f</i> = 11 (18%)		
	Historical	<i>f</i> = 3 (5%)		
1	No recall	<i>f</i> = 35	12.7	35

the three memories (Level 3). Level 4 accounts for 30.8 per cent (*N* = 82) of the sample, recalling all three memories. The third most frequent level of differentiation is Level 2, 22.1 per cent (*N* = 55) of the sample. Only 12.7 per cent (*N* = 35) of the sample recalled none of the three memories (Level 1).

From a developmental viewpoint one would hypothesize that the relative state of differentiation and integration of the *S*'s memory subsystem organization of past experiences will bear a direct relationship to his conception of futurity. More specifically, the authors' expectation is that those *S*s who recall all three memories will have a greater frequency of future ambitions than will those *S*s who recall fewer than three memories.

In the reduced sample of 268 *S*s, future ambitions were elicited from 90 centenarians (33.5 per cent), while 101 (38.3 per cent) declared they had no ambitions and 77 (28.2 per cent) did not respond to the question.

Next, Table 4 represents the frequency breakdown of the future ambition responses for each (corollary) level of differentiation of the recalled memories. In column one we notice that there is a linear increase in the percentage of *S*s not answering (or unable to answer) the future ambition item as we proceed from Level 4 (greatest differentiation of memories) to Level 1 (least differentiation or no recall). Only 15.6 per cent of the *S*s at Level 4 did not respond;

percentages for the remaining levels were, 23.4 per cent Level 3, 28.6 per cent Level 2, and 32.4 per cent Level 1. Chi square (4×3) analysis of all cell frequencies in Table 4 yields a χ^2 value significant beyond the .01 confidence level.

As further analysis will deal with the differentiation of responses in Table 4, the entries in column one (no responses to the future ambition item, $N =$

TABLE 4
FREQUENCY OF FUTURE AMBITION RESPONSES ACROSS LEVELS OF DIFFERENTIATION

Level of differentiation	No response	No ambition	Yes ambition	N
4	12	26	44	82
3	18	45	33	96
2	22	22	11	55
1	25	8	2	35
Total	77	101	90	268

77) and the entries in row four (Level 1 of memory differentiation scale, $N = 10$) have been excluded, reducing the total analyzable responses to $N = 181$. By excluding "no" responses which are qualitatively different from differentiated responses (either in terms of number of memories or future ambitions), the authors restrict the heterogeneity of variance to differentiated responses only.

Thus, Table 5 lists the frequency of future ambition responses for three levels of memory differentiation. Chi square analysis (3×2) for the total

TABLE 5
 χ^2 TABLE (3×2) OF FUTURE AMBITION RESPONSES FOR
THREE LEVELS OF DIFFERENTIATION

Level of differentiation	No ambition	Yes ambition	N
4	26	44	70
3	45	33	78
2	22	11	33
Total	93	88	181

table yields a significant χ^2 value of 9.88, $df = 2$, $p < .01$. The relationship between differentiation of the past and the presence or absence of future ambitions ("yes" responses) obtains for the total table.

Within Table 5 comparisons were made between the following rows or levels; Level 4 and Level 3, $\chi^2 = 6.27$, $df = 1$, $p < .02$; Level 3 and Level 2, $\chi^2 = 0.79$ ($df = 1$); $p > .05$ (n.s.); and Level 4 and Level 2, $\chi^2 = 7.80$, $df = 1$, $p < .01$. Level 4 responses are distributed significantly different

from Levels 3 and 2 with respect to the presence or absence of future ambitions. Level 3 is not significantly different from Level 2.

The above findings indicate that the corollary scale of differentiation of memories is reduced to a dichotomy. Successful recall or differentiation of all three memories significantly relates to or predicts the presence of future ambitions. We would expect the present results to obtain greater relationships of significance were one to sample a greater number of memories.

Methodologically, it is important to sample enough behavior—in this case, a minimum of three qualitative memory items. Partial sampling of the memory field may not discriminate among Ss who have varying degrees of differentiation of recall.

D. DISCUSSION

The corollary scale of differentiation (memories) is only a simple *index* of the process of differentiation. There is no intention to equate the number of recalled memories with the psychological process of differentiation. More systematic analyses can be achieved by examination of differences within the memory responses themselves, which is beyond the scope of this paper.

The present research is guided by a model of development that enables one to select out from a mass of data a set of relationships that pertain to time perspective. Analysis of time perspective requires a determination of where the individual locates himself in his own "temporal life-space" or "life-gestalt," and how he is using other points of reference to organize a perspective.

One might construct, out of limited data, a picture of a certain group of centenarians who have a rich reservoir of recollections dated very early in life (5-12 years). These people are vividly engrossed in these experiences in a manner that suggests a well maintained and preserved "pastness" dimension. They appear motivated to scan their remote past experiences. These people also have a rich set of recollections throughout their total life span. For those centenarians whose early memories are bleached out or who do not enjoy reaching into their past, it is doubtful that they possess a full sense of time perspective. Such persons perhaps are more affected by the pressures of the immediate environment.

An excellent example of using earliest memories, and the reconstruction of past life as research data on current and covert states of the aged, is that of Tobin (6). Considering early reminiscence as the overt reflection of ongoing adaptations to current stress, Tobin tested the hypothesis that institutionalization would evoke a restructuring of the earliest memory. "That is, the implicit

hypothesis is that a *current* stress would evoke a *change* in the content and elaboration of the earliest memory" (6, p. 2). It was found that, after institutionalization (two months), those Ss showed significantly more shifts toward themes of loss in their memories than did a matched community sample.

In an attempt to explain increased reminiscence in the aged, Butler postulates the "life review." Butler suggests that the basis of the life review is the sense of impending death and its function is the reintegration of personality and preparedness for death. The engrossment in early time periods found for the present sample of centenarians is compatible with observations Butler has reported: "Older people report the revival of the sounds, taste and smells of early life. ('I can feel a spring afternoon of my boyhood')" (1, p. 525). The finding that the earliest memory (EM) is recalled most frequently by the centenarians in this study supports Butler's comment that "... older people may be preoccupied at various times by particular periods of their life and not the whole of it" (2, p. 88).

Other investigators have theorized about the nature and function of time perspective among the aged as a means of maintaining self-continuity throughout the life-span. Kastenbaum (4) has suggested several functions of a time perspective for the individual:

If a time perspective can serve to accommodate affect and, therefore, afford the individual an alternative to quick response and impulsive discharge of tension, then the person who is disinclined to consider the past will tend to be deprived of this coping procedure.

A previous study suggested that most adolescents in a normal sample had an aversive, blocking-out reaction toward their personal past. The implication might be that one of the developmental tasks which still lies ahead for many adolescents is the ability to take pastness into account in elaborating a cohesive view of life. By contrast, the developmental task of the aged person might be to find a way of maintaining the future-scanning function. Neither the adolescent who ignores the past, nor the aged who ignores the future could develop or maintain a genuine time perspective, according to the present line of reasoning (4, p. 199).

It might be suggested here that one of the developmental tasks of the centenarian is to find a way of maintaining the past-scanning function and linking it with his other modalities. The vivid early childhood memories and rich recollections of his total past offer the centenarian a means for creating a perspective on his present and future. The reservoir of memories helps sustain his present moment of existence and also aids him in creating a perspective in preparation for his eventual death.

E. SUMMARY

An inquiry was made into some aspects of the past and future outlooks of 276 centenarians, based upon interview protocols provided by the Social Security Administration. Developmental-field concepts were applied to the analysis of items pertaining to Earliest Memory, Most Exciting Event, and Most Salient Historical Event, as well as Future Ambitions. Earliest Memory was the recall item most frequently answered. The centenarians tended to put their memories into perspective rather than show engrossment in their recollections. There was relatively more engrossment in the telling of memories that were dated in the remote as compared with the recent past. Those centenarians who were able to offer responses for all the memory items more frequently stated future ambitions than did their peers who had less command over the past. Implications of the study are discussed with particular reference to the functions of time perspective in the later years of life.

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AGE DIFFERENCES IN MEMORY OPTIMISM AND PESSIMISM IN WORKERS* ¹

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A. INTRODUCTION

The problem of age differences in memory optimism or pessimism as here considered involves two areas of knowledge—psychological aspects of aging in men and the role of emotions on memory. The problem of aging surveyed in the *1965 Annual Review of Psychology* (4) covers all psychological aspects. Memory studies are reported, but the emphasis is on memory deficit. Industrial studies are considered with attention to production, absenteeism, and job changes. Other studies of aging in industry deal with work and life adjustments (13, 14, 15). More closely related to the present study are articles on personality change with aging (1). Some of the methods used by Neugarten and associates (16) are related to the methods used in this study. But, all in all, in publications on aging to date, nothing is reported about memory dynamics in the sense of the role of emotions on memory in relationship to age, the main problem of this study.

The first comprehensive consideration of the problem of emotions and memory was made by Rapaport (18). In this volume he surveyed the philosophical treatment of the problem, the Freudian viewpoint, and evaluated the experimental studies beginning with Meltzer's review (9) and studies (10, 11). He begins the chapter on historical background with this sentence: "The past of our knowledge 'of the influence of the emotions on memory' is long, but its history is brief and foggy" (18, p. 4). By now the history is less brief, somewhat less foggy, and more characterized by more easily perceived gaps of knowledge as well as more openly debated controversy.

Purcell, 10 years later in a study on memory in relationship to psychological security, had this to say about the status of the problem: "The problem of memory dynamics is one which has long been attended to but not yet resolved in

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¹ In the main, as presented before the Gerontological Society, Los Angeles, California, November 11 to 13, 1965.

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many of its aspects" (17, p. 433). In this article he reported his own study on the relationship of memory to psychological security as measured by Maslow's security-insecurity test (8) and called attention to the need for study of significant individual factors with emphasis on personality factors on memory dynamics. He quoted Waldfogel favorably in the following words: "... more work should be done in dynamics of memory optimism and memory pessimism and on personality differences between memory optimists and memory pessimists" (20, p. 31). In Rapaport's as well as Purcell's studies, credit was given to Bartlett (3) for the formulation of a theory on memory as an instrumental function serving certain individual ends. This hypothesis, said Purcell, is identical in meaning with the emphasis of Edwards (5) and Barrett (2) on the frame of mind or frame of reference hypothesis. Both statements imply that those experiences that harmonize best with the current frame of reference will be best remembered. In Purcell's study, which calls attention to the need for studying individual differences in memory optimism and pessimism, no reference is made to the one study of this topic (10).

MacKinnon and Dukes (7) again tried to review the historical background, Freudian concepts, and all the work that has been done since, with particular emphasis on what is referred to as a search for experimental studies with implications for repression. Included in their chapter on repression are studies on relationship of interrupted tasks, failure, perceptual defense, and guilt to memory dynamics. "In retrospect," the authors say, "the experimental psychodynamicists of the 1930's would appear to have achieved far less than they had hoped, and by the end of the 1940's they had largely disappeared from the psychological scene. But the late 1940's change in the *Zeitgeist* of psychology was everywhere apparent" (7, p. 709).

From 1945 on, it is the "hard-headed" experimentalists, not the "soft-headed" clinicians and personalogists, who took over the problem of repression and turned it into a problem of perceptual defense. Near the end of the chapter they expressed the impression that this does not imply that "the investigation of perceptual defense has been noticeably less free of controversy and acrimonious debate than the earlier attempts to study repression. But this time the argument has been more among psychologists than between psychologists and psychoanalysts. In a curious and interesting way, most of the criticism of these later researches boils down to a denial that the investigator has indeed dealt with a demonstrated process or mechanism of perceptual defense" (7, p. 736). Purcell's study on the relationship of memory dynamics to psychological security is not mentioned.

Goldin (6) attempted to bridge the gap between level of awareness and

selective memory in relationship to the concept of repression and defense. In this integrated effort, no reference was made to early experimental studies (18) or Bartlett's formulated theory of remembering (3). In the present study no attempt will be made to bridge all the gaps and unify concepts out of the laboratory with concepts out of the psychoanalytic couch, nor to settle arguments about the significance of individual differences against emphasis on general laws (19). Instead an attempt will be made to present some needed knowledge in the form of a report of the role of memory dynamics in the lives of 143 workers, which can be used to advantage for more realistic, theoretical considerations and for diagnostic purposes. More specifically, the present study concerns itself with the age factor in memory dynamics, which has been completely neglected in the literature on the subject. The questions raised in this study expressed in a form of general hypotheses are (a) when asked to recall outstanding experiences in their lives, workers will express more pleasant than unpleasant memories; (b) younger workers will show a greater predominance of pleasant over unpleasant memories than will older workers; and (c) younger workers will be differentiated from older workers by the nature of memories expressed.

B. METHOD

1. *Subjects and Setting*

The subjects used in this study were 143 workers in a paper-converting industry located in a stable college community in upstate New York. For the purpose of this study they were divided into the five age groups used in previous studies: 20-29, 30-39, 40-49, 50-59, and 60 up. Percentages in each group arranged in sequence are as follows: 21.68 per cent, 25.17 per cent, 25.8 per cent, 18.18 per cent, and 9.09 per cent. For purposes of bringing more clearly to a focal point the differences between older and younger workers, the group was also studied in terms of workers before and after age 40. Of the total group, 67 or 46.85 per cent were 40 or younger, and 76 or 53.14 per cent were older than 40. This paper mill is the only plant of any size in the community. Obtaining a job there was at that time considered the beginning of establishment for a good many people who lived in the community.

2. *Source Material*

The source material used is based on initial interviews with workers who were taken over by a new company. The interviewers were representatives of the new company, and the attitudes of most of the workers toward them were extremely favorable because of dissatisfaction with the old company. The

interviewers were all experienced in employment interviewing including projective interviewing. The interviewers in addition to the senior author were Dr. Kenneth Ball, presently Director of Industrial Relations at Orchard Paper Company, who was at that time a Ph.D. candidate at Washington University with four years of experience in interviewing, and Miss Ruth Lambert, personnel assistant in the parent company with a M.A. in Psychology and two years of interviewing experience.

3. Procedure

The interview was structured in the following sequence (12):

1. Direct questioning about work, family, personal story, and present conditions or problems.
2. Recall of the most outstanding pleasant experience with the question, "And now tell me what comes to your mind when you think of the most outstanding pleasant experience of your life."³
3. Recall of other outstanding pleasant experiences.
4. Recall of the most outstanding unpleasant experiences.
5. Recall of other outstanding unpleasant experiences.
6. Questions concerning personified values. a. Who is the greatest person that ever lived? Why? b. Who is the greatest person living? Why?
7. Questions concerning personified ideal or aspiration: Of all the people you've ever seen, heard about, or read about, whom would you rather be like? Why?

Measures were also obtained for work competency, autonomy, and interpersonal competence. The purpose was to explore the relationship of memory dynamics to personality variables. The findings from this study the authors plan to report as a follow-up paper, hence the details about these measures are omitted from this study.

C. RESULTS

1. *The Age Factor in Memory Dynamics (Hypothesis 1)*

a. *Age Comparisons in Selective Recall.* At every age group studied, as well as with the total number of workers taken as a group, selective memory in favor of more pleasant than unpleasant is manifest. Moreover, in each group the difference in favor of the pleasant is statistically significant and gives strong support to Hypothesis 1. The data for each group, the chi square,

³ Request for pleasant and unpleasant recall did not invite or suggest concern over attitude toward management. The questions were relatively unstructured and invited memories of a lifetime.

and the level of confidence are reported in Table 1. The level of confidence is somewhat higher for the younger age group than for the older. Even at the highest age level, the level of confidence is .05. This finding suggests that personality factors rather than the age factor as such are influencing memory dynamics involved.

TABLE 1
A COMPARISON OF PLEASANT AND UNPLEASANT MEMORIES

Age group	N	Memories, total pleasant	Memories, total unpleasant	Chi square	Level of confidence
20-29	31	69	30	15.35	.001
30-39	36	98	33	32.26	.001
40-49	37	81	43	11.64	.001
50-59	26	63	32	10.12	.01
60 +	13	26	11	6.08	.05
Total	143	337	149	72.72	.001

b. Age Differences in Memory Optimism and Memory Pessimism. As a single measure of memory optimism or pessimism, the P-U Potency Index⁴ was used. A plus score was interpreted as indicating memory optimism, a minus score as indicative of memory pessimism, and a zero score as indicative of indifference. To study age differences among the five age groups, the P-U Potency scores were calculated for each age group. The only significant difference found was between the means of the 30-39 group and the 40-49 group at a level of confidence of .02; the former group had a higher P-U Potency (mean of 1.81) than did the latter (mean of 1.00). Some of the other comparisons approach significance. A clear picture of the trend over the different ages is given in Figure 1. The P-U Potency shows a substantial increase between the first two age groups, then drops significantly from the 30-39 to the 40-49 groups. This measure then levels off for the last two age groups at a level that is somewhat below that of the 20-29 age group. This is almost significantly lower than the 30-39 age group. Thus, in general, the results give very limited support to Hypothesis 2 when viewed in this fashion.

c. Memory Optimism and Pessimism with the Passing of Time. What trend differences exist between long- and short-timed memories of personal experiences? How do lifetime memories compare with a six-week span, for example? The memories of the workers were of a lifetime, and no measure of their short-time memories is available. However, data concerning a six-week

⁴ This scale refers to the predominance of pleasant over unpleasant memories derived by subtraction of the number of unpleasant from the number of pleasant memories [first used by Meltzer (10, p. 406)].

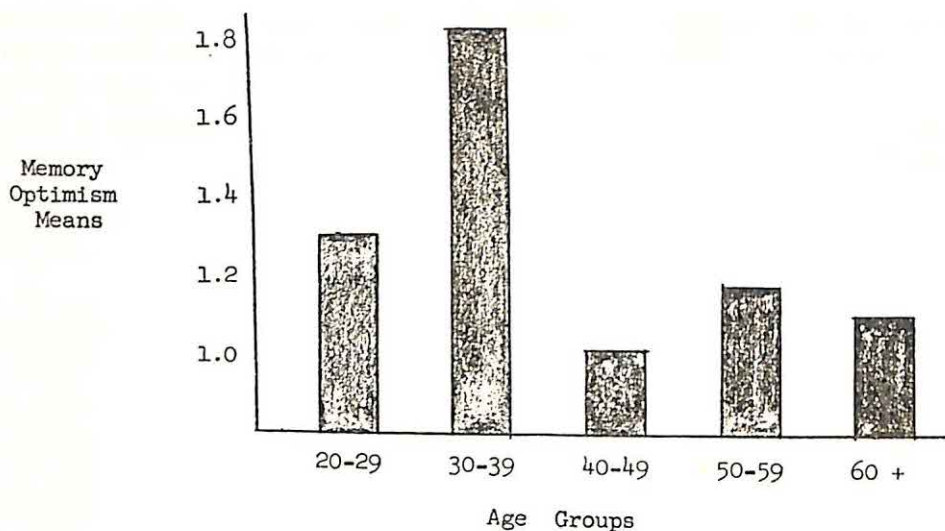


FIGURE 1
AGE DIFFERENCES IN MEMORY OPTIMISM

period in college students are available (10).⁵ When these two groups are compared on memory dynamics we find the following differences: 56.49 per cent memory optimists for the six-week period as compared to 77 per cent for lifetime memories; 35.89 per cent memory pessimists for the six-week group and 4.9 per cent for lifetime; indifferentists for the six-week period, 7.64 per cent, and for a lifetime, 18.1 per cent. Thus, we find more memory optimists and more indifferentists in the life span than in a six-week span, and more pessimists in the short span. A greater indifference with the passing of time is to be expected as a result of decreased intensity of memories. It might be argued that repression enters in at this point. The greater optimism and lesser pessimism could more clearly be interpreted as a consequence of repression.

2. *Memory Dynamics Before and After 40 (Hypothesis 2)*

For a more concise picture of likely age differences the total group was divided into two large groups, before and after age 40. In Table 2 are presented the means, standard deviations, *t*-values, and confidence levels to make

⁵ It should be noted that few of the workers used in the present study went to college; thus it would be a more valid comparison if the two groups were both college students or workers. Since such data is not available, however, this comparison can throw some light on the effects of time on memory dynamics and suggest a follow-up study of a more valid nature.

possible a comparison of the memories of the two groups of workers. The mean number of pleasant memories recalled by those under 40 is 2.52, as compared to a mean of 1.70 for those over 40. This difference is not statistically significant (t -value of 1.16, $p < .21$). The trend seems to be in the direction of those under 40 giving more pleasant memories than do those over 40. A glance at the unpleasant memories shows an opposite trend; those over 40 gave more unpleasant memories than did those under 40. The difference here approaches

TABLE 2
PLEASANT AND UNPLEASANT MEMORIES BEFORE AND AFTER 40

Factor	Age group	Mean	SD	t value	Level of confidence
P	Before 40	2.52	1.36	1.16	.21*
	After 40	1.70	1.50		
U	Before 40	.88	.38	1.86	.07*
	After 40	1.11	.66		
P-U	Before 40	1.60	1.45	2.35	.02*
	After 40	1.09	1.28		

* Two-tailed test used.

statistical significance with a t -value of 1.86 and a .07 level of confidence. On the P-U Potency Index, which is a relatively more reliable measure of a trend toward memory optimism or pessimism, the mean for the younger workers is larger than for the older workers. The t -value of 2.35 is significant at the .02 level and gives indication that those under 40 have a greater tendency toward memory optimism than do those over 40. Thus the above approach to testing the second hypothesis by division of the workers into the under and over 40 age groups proves to be profitable and gives some support to this hypothesis.

3. *Age Differences in the Nature of Pleasantness and Unpleasantness (Hypothesis 3)*

To bring out more clearly the differences between the nature of pleasant and unpleasant memories by age, an attempt was first made to classify all experiences for each of the five age groups; but it became fairly obvious that a clearer and more concise picture could be obtained by breaking the group into two groups, before and after 40. The memories were classified according to types of experience. All of the categories used are self-explanatory, and all the types of memories given with a frequency greater than five are presented in Table 3. The frequencies of the memories for the two age groups, before and after 40; chi square; and a level of confidence for each type of experience are also given in Table 3. A review of Table 3 indicates relatively few outstand-

ingly significant differences between the younger and older groups. Two statistically significant differences are "discharge from service" more frequently mentioned by the younger group ($p < .001$) and "health and friends" more frequently mentioned by the older group ($p < .01$). At a lower level of confidence the younger generation more often mentions "achievement," whereas the older group more often mentions "family" and "material goods." The differ-

TABLE 3
DIFFERENCES IN THE NATURE OF MEMORIES BEFORE AND AFTER 40

Factor	Type of memory	Frequency before age 40 ($N = 67$)	Frequency after age 40 ($N = 76$)	Chi square	Level of confidence
P	Family	38	53	2.71	.10
	Marriage	40	41	—	—
	Material goods	18	30	2.53	.20
	Achievement	23	16	3.16	.10
	Service (discharge)	28	3	22.75	.001
	Hobbies	14	12	—	—
	Health and friends	2	14	8.54	.01
	Pride in work	4	8	—	—
U	Illness and death	25	54	16.39	.001
	Physical injury	14	10	—	—
	Military	8	1	6.82	.01
	Work experiences	1	7	4.02	.05

Note: P = pleasant and U = unpleasant memories.

ences between "pride in work" and "marriage" are not significant. As sources of unpleasant memories there were three statistically significant differences: "military service" were more often given by the younger group, and "work experience" and "illness and death" were more often given by the older group. In view of the results given above, some support is given to Hypothesis 3 which predicted that younger workers would be distinguished from older workers on the basis of the nature of memories.

4. *Ego Defensiveness*

In the original plans for this study the problem of ego defensiveness as such was not included, but in working with the source material the actual memories given by the workers revealed enough to indicate a need for such a study. In reviewing some of the life stories of the people who reported differentially, it was easy to see that not all the people who reported no unpleasant experiences are eternal optimists. Again, not all the people who were classified as memory pessimists were always full of ego defensiveness, and not all who were classified as indifferent were emotionally dead. Ego defensive-

ness was found in all the groups. There is an interesting problem here worthwhile studying with an experimental design in mind. In this paper, however, the authors will merely select illustrative material to give some cues concerning the nature of the things that need studying in a more thorough fashion.

There were 31 people who gave no unpleasant experiences. Ten were in the youngest group (20-29), six were in the 30-39 group, seven in the 40-49 group, four in the 50-59 group, and four in the 60 and above range. The interesting thing about this data is that the 30-39 group, which statistically has the most memory optimists, has less than its share of people in this group. More of them are more realistic and natural in their memories, apparently, than are members of the group that gives no unpleasantness. The oldest group had more than its share of people reporting no unpleasantness. There is something here in the nature of a personality factor or factors which are related to a problem of memory dynamics; and the predominance of pleasantness over unpleasantness, as such, cannot be taken in all instances as a reliable measure of optimism or pessimism. Here are some illustrative people from this group:

1. A 27-year-old man gave marriage as the outstanding pleasant experience. Thereafter he said, "That's all. There's no pleasantness that stands out in my mind." In this case he was not really taking the Fifth Amendment because a reading of his life story revealed what some Rorschach blots suggested about him: namely, he was stereotyped, unresourceful, unproductive, vague, and cloudy-minded. He said his health was good, but he had pleurisy. He had an operation 14 years ago and had a back rib taken out and has felt good ever since. He was inexpressive throughout the interview. His level of ambition, as he talked of himself, was low; but he was not a complaining man. He was complacent about things others would not be complacent about. His father, 66 years old, also worked in the plant. His mother was dead. He had been married 10 years. His wife was 29, a high-school graduate, and worked at Western Union. They had an 8-year-old daughter. For his wife, he changed his religion from Catholic to Methodist. He did not want any more children because he could not support a big family. He had few interests—movies—did not drink, stayed home, took a ride once in a while—and that was life for him. This was not a life full of rich memories. He rated low as a worker. Even though he gave nothing but pleasant memories, he was far from being an eternal optimist.

2. A 20-year-old man who hated his boss reported no unpleasantness but rather two pleasant experiences, getting married and graduating. Yet, in the interview he talked at length about how hateful his boss was and said that

every worker hated him and wanted him to be fired. This hatred was intense as he talked about it, but still he did not give it as an unpleasant experience when recalling his memories. In his case, apparently, immediate circumstances somehow were not included in unpleasantness of a lifetime. He rated well as a worker. He was born and raised in the same area. He expressed nothing that would indicate a desire to advance.

3. The hated boss, a 56-year-old person who was the assistant paper mill superintendent with 65 people working for him, also gave two pleasant experiences and no unpleasant. He said he was in good health. He had rheumatism but was certain he was over it because it did not bother him any more. He expressed frustration by his former boss. He was the oldest in a family of six boys and three girls. His father died when he was 4 years old. His mother remarried, but his reaction to the second man his mother married, or so-called stepfather, was "Oh, yes, he was a rough fellow, who died in 1943." He did not affiliate with his stepfather and was raised by grandparents. His first wife left him in 1935; he married again in 1947. He was married 20 years to his first wife and had four children. The chief source of difficulty with his first marriage was financial. Pleasantness in his life was almost entirely memories or episodes like getting rid of his first wife, overcoming loss of money and property, and the like. He seemed to lack a sense of freedom to think about himself except in an extremely limited manner. He was rated low in both self-assurance and interpersonal competence. Although he knew he was hated by his workers, he, like his worker, did not include that in unpleasant memories. In this case the generalization made by Barrett (2) that experiences are remembered that harmonize best with the current frame of reference does not seem to hold in memories of a lifetime.

There were seven people who gave more unpleasant than pleasant experiences. What kind of people were they? They ranged in age from 20 to 54. Age, as such, was not the differential factor. The following is a description of one of these memory pessimists:

The one person, a 22-year-old man, who reported nothing but unpleasant experiences, said when asked about pleasant ones, "I can't think of anything." His unpleasantness included almost falling in the chip bin on the job. For the rest, all he could see was that his whole life was unpleasant. He does not do much with his spare time, does not have many hobbies, does not do much for recreation and does not date at all. He used to fish, but does not do that any more. He spends a fair amount of his time fighting with his father. If it was not for his father, he probably would have no job. At the time of his interview he definitely was a memory pessimist, and unless drastic changes take place in his

life he is likely to remain this way. In this case here is a man who still has to find himself. He rated low in both self-assurance and interpersonal competence and inferior as a worker.

Of the group who showed an equal number of pleasant and unpleasant memories, not all are alike and their ages range all the way from 19 to 64. The oldest, a 64-year-old man, said marriage was the most pleasant thing in his life; and getting his toes cut off was the only unpleasant thing. For a 62-year-old worker, the day he got married was the outstanding pleasant experience, and the sickness of his wife was the only unpleasant experience. For a 19-year-old boy, getting a car was the chief source of pleasantness, and losing a car was the chief source of unpleasantness. A 49-year-old man had two pleasant and two unpleasant experiences. Pleasantness was the birth of his baby and being in New York where he saw the Yankees play baseball, and unpleasantness was the death of his brother and the death of his father. A 47-year-old man gave marriage and the birth of his daughter and an honor he received from the Boy Scouts as sources of pleasantness; diabetes of his daughter, illness of his father, and unjust criticism on the job were his sources of unpleasantness. The memories of this indifferent group do not reveal a storehouse of rich memories and indicate that memory indifference and a lack of rich memories seem to go together.

The observations made warrant the conclusion that there is enough interesting material here to make it worthwhile studying the problem of ego defensiveness in memory optimists, memory pessimists, and indifferentists in a planned and thorough manner.

D. SUMMARY AND CONCLUSIONS

The problem of age differences in memory optimism or pessimism as here considered involves two areas of knowledge—psychological aspects of aging in men and the role of emotions on memory. The subjects used were 143 workers ranging in age from 20 to over 60. For purposes of this study, they were divided into five age groups. For some specific purposes the group was divided into two sections, above and below age 40. The source materials used were the life and work stories of the workers, which included projective interviewing in the sense of obtaining their recall of outstanding pleasant and unpleasant experiences in their lives. Life was experienced in a small college community in upstate New York where there was but one large company, the paper mill in which they worked. On the basis of the memories of these workers, the findings may be summarized in the following manner:

1. Each group studied, as well as the group as a whole, expressed signifi-

cantly more pleasant memories than unpleasant. The level of confidence ranged from .001 to .05. These findings suggest that personality factors rather than age, as such, are influencing predominance of pleasantness over unpleasantness. The data in the full study suggest that memory dynamics are best understood as a problem in social psychology, and personality factors involved are best conceived of as being influenced by economic, industrial, and social factors in the lives of the people investigated.

2. When the group was divided into only two groups, before and after 40, it was the younger group that reported more pleasant memories and the older group that reported more unpleasant memories. The P-U potency, the measure of predominance of pleasantness over unpleasantness, was larger for the younger group than for the older group.

3. When the means for all the groups were compared on memory optimism, or P-U potency, the results obtained indicated a peak of predominance of pleasantness over unpleasantness at the age of 30-39. How it runs over the years is indicated in Figure 1. The only statistically significant difference was found between the means of 30-39 and 40-49 age groups ($p = .02$), with the former having the higher P-U potency. Some of the other comparisons approach significance.

4. There are some significant differences in the nature of pleasantness between the younger and the older groups. Outstanding is "discharge from service" as a source of pleasantness for the younger group, below 40; and "health and friends" for the older group. On unpleasantness, "illness and death" is more frequently mentioned by the older than by the younger group. "Military service" is a source of unpleasantness for the younger group. Other differences approach statistical significance. This material is presented in greater detail in Table 3.

5. With the passing of time, changes take place in memory dynamics. When the six-week memories of a college student group were compared to the life experiences of the workers, the direction of change was as follows: an increase in memory optimism, a decrease in memory pessimism, and a substantial increase in indifference. These results can be interpreted as a consequence of repression. It would be interesting to study this problem where both the short and life memories are of the same people.

6. Some illustrative material concerning the style of ego defensiveness in memory optimists and pessimists is presented for the purpose of indicating that there is material worthwhile studying with experimental design. The material presented merely illustrates the fact that not all people who give no unpleasantness have had none as judged by a reading of their life stories, and not all

people who give more unpleasantness are necessarily more ego defensive; but those who show memory indifference do seem to lead a somewhat less rich and vivid life than the realistic memory optimists, who are realists in the sense of including some unpleasantness as well as pleasantness in their memories as contrasted to wishful or "eternal" optimists who report no unpleasant experiences.

7. A review of the findings reported suggests a need for further studies of the relationship of memory dynamics to performance and motivation and the role of personality variables on memory dynamics. Also indicated is a need for the study of memory dynamics of workers living in communities which offer a wider range of possibilities for experiences than does the community in which the workers in this study lived. A study of the relationship of memory dynamics to personality variables has been completed. Plans for the study of memory dynamics in white collar to blue collar workers and community differences are in progress.

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PROBLEM SOLVING IN RATS AS A FUNCTION OF EXPERIENCE AT DIFFERENT AGES*

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A. INTRODUCTION

Following the findings of Hebb (6) on the effects of early experiences on later behavior in rats, researchers (3, 5, 8) have demonstrated that rats raised in a large and varied environment will be superior in problem-solving behavior at maturity to rats raised in a restricted environment. To be effective, exposure to this "free environment" had to take place before maturity (8). In order to define a more restricted age range in which exposure to a free-environmental condition is effective, researchers have attempted to find "critical periods" within the developmental period. Forays and Read (4) found that rats exposed at the age of 22 to 43 days made less errors on the Hebb-Williams closed-field problems than did rats exposed at earlier or later ages, while Eingold (2) using the same test found a critical period around a mean age of 55 days.

Denenberg (1) suggested that the critical period is a function of intensity of stimulation and Forays and Read (4) hypothesized on a possible interaction of dimensions of amount of experience and age: that is, they suggested that a greater amount of experience during one developmental period may produce the same results as a smaller amount of such experience during another period.

The present study attempted to investigate this hypothesis. Adapting Eingold's age periods with means of 35, 55, and 75 days, it was predicted that (a) some periods will be more effective than others, (b) amount of exposure will vary with problem-solving behavior in adulthood, (c) less exposure during a "critical period" may be as effective as more exposure during a non-critical period, and (d) an additional period of free environment in adulthood (after testing) will not result in a change of level of performance.

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B. METHOD

1. *Subjects*

Fifty-six male hooded rats were randomly assigned to six experimental groups and one control group of eight animals each. At the age of 25 days all animals were weaned and housed in groups of three or four animals in small laboratory cages, $10 \times 8 \times 8$ inches. Each cage was surrounded by unpainted masonite walls, thus providing an experience limited in visual and spatial experience. Food and water were available at all times in those cages.

2. *Infantile Experience*

At the age of 30 days, experimental groups A8 and A1 were removed from their home cages and were placed in the free-environment situation (see *Free Environment* below). For a period of 10 days (age 30 to 40 days), group A8 remained in the free-environment cage for eight hours daily, while group A1 received only one hour of the same experience. At the age of 40 days, both groups returned to their home cage until maturity.

At the age of 50 days, the same 10-day period of treatment was given to groups B8 and B1, who received their treatment from age 50 to 60 days. Experimental groups C8 and C1 received the same treatment from age 70 to 80 days.

When not treated, animals remained in their restricted home cages. The control group remained in the home cages throughout the developmental period.

3. *Adult Experience*

Following a 15-day testing period at maturity, all experimental animals were once again placed in the free-environment cage for 10 days (age 100 to 110 days), and remained there continuously for 24 hours per day. In this situation the 23-hour food deprivation schedule, started at testing, was maintained. Water was available at all times. The control group remained in the home cages on the same feeding schedule.

4. *Apparatus*

As the free-environment situation contained simplified versions of the testing apparatus to be used at maturity, the description of the apparatus will precede that of the free-environment situation.

At maturity (86 days of age) all animals were tested by means of a T-maze, requiring Visual Discrimination. The overall height of the maze was 6 inches. The stem was 12 inches in length and 3 inches wide, with equal arms 16 by $4\frac{1}{2}$ inches. The top was covered with $\frac{1}{4}$ -inch wire mesh. Everything inside the

maze was painted flat black. The discrimination problem, situated on the floor of the maze at the end of and on either side of the stem, consisted of two white stripes on a black background running parallel with the direction of the stem on one side and two white stripes running in the direction parallel with that of the arms on the other side. The stripes measured $2\frac{1}{2}$ inches in length and were $\frac{1}{2}$ -inch wide, and were painted on thin $2\frac{1}{2}$ - by $2\frac{1}{2}$ -inch plywood squares placed on the floor, thus providing an easy way to change the position of the cue. Vertical one-way doors, situated immediately behind the discrimination problem, allowed the animal to enter the arm (goalbox). The door following the stripes parallel with the arm led to a white jar containing three 97 mg reward pellets, while that on the opposite side led to an empty jar, thus providing a noncorrective method. Entering the wrong goalbox was counted as an error.

One hour after the trials on the Visual Discrimination T-maze, each animal was also tested on an Alternation Maze I, requiring Spatial Discrimination. The maze was 55 inches long, 6 inches wide, and 6 inches high. The alley consisted of four units, each 10 inches in length, and a 15-inch long goalbox. Each of these four units was separated by pairs of vertical one-way doors, $2\frac{1}{2}$ inches wide. One door of each set could be closed by means of a vertical metal bar, attached to a center post which separated the two doors and which could be turned in such a way that it always closed one door and left the other door free to be pushed open. Thus the animal was required to find its way through the goalbox by opening four doors, the sequence being RLLR for half the number of animals and LRRL for the others. Pushes against wrong doors were counted as errors, to be observed by means of vertical metal rods attached to the doors. Everything inside the maze was painted flat black, so that no visual cues were present.

At the age of 110 days (following an additional free-environmental period), all animals were tested by means of variations II-F and II-G of the Hebb-Williams series of elevated mazes (7). The mazes were identical in size with those used by Hebb and Williams, but were enclosed by brown masonite sides rather than unpainted wood, and the stripes and sideshelves were painted flat black. Errors were counted whenever an animal missed a correct turn by a full body-length or more (excluding the tail), while another error was counted whenever an animal turned around and ran into the opposite direction for one body-length or more. Starting always took place at the front of the right sideshelf, while the jar containing the 97 mg reward pellets was placed on the front of the left shelf.

At the age of 120 days, all animals were tested by means of Alternation

Maze II. This maze differed from Alternation Maze I only in that a different problem was to be solved. Animals that had run a LRRL sequence on Alternation Maze I were now required to run an RLLR, while those who had run a RLLR sequence now ran LLRR.

5. *Free Environment*

The treatment cage, providing free-environmental experience, was 56 inches long, 27 inches wide, and 15 inches high. The floor, three sides, and the back were covered with unpainted masonite. The front and the top were made of $\frac{1}{4}$ -inch wire mesh. Wood shavings covered the floor. Besides a number of "playthings," the cage contained the testing apparatus as described under the heading *Apparatus*, but simplified. In the T-maze the discrimination problem consisted of a white circle, one inch in diameter, on one side, while the other side was left black, thus requiring the animals to perform the easier discrimination (9) between the presence and absence of a figure. Food was only to be found in the goalbox associated with the circle, while the other side led to an empty goalbox. One-way doors at the end of the goalbox allowed the animal to re-enter the free-environment cage. Of the Alternation Maze, only a three-unit part was used, the third unit being the goalbox which always contained food. The sequence of open doors was changed daily in a random fashion. At any time, only one of the two mazes was placed in the free-environment cage, and the mazes were interchanged daily. Optimal use of the apparatus was assured by depriving treatment animals the night before treatment and by placing water elsewhere in the cage.

For the additional period of free environmental experience in adulthood, the cage was equipped with two elevated wooden strips, $56 \times 2 \times 1$ inches, attached to the side walls 12 inches apart and 12 inches above the floor. On the left side of the cage the strips were connected by means of a 3-inch wide wooden platform which could be reached by means of a "ladder" (a 3-inch wide wooden strip covered with wire mesh and placed on an angle of approximately 45 degrees. Another platform 12×12 inches was placed on the opposite (right) side of the cage, which contained food (for one hour a day) and water (always) and could be reached by means of the wooden strips. Thus the total situation formed a detour problem in preparation for the elevated Hebb-Williams mazes to be used later.

6. *Testing Procedure*

At the age of 81 days, all animals were placed on a 23-hour food deprivation schedule. Days 81 to 85 were used to prepare them for the testing period. On

days 81 and 82 they were adapted to the 97 mg reward pellets in individual feeding cages, on day 83 they were adapted to the starting box, and on days 84 and 85 they were allowed to explore the Visual Discrimination T-maze and the Alternation Maze. The problems were removed during this adaptation period and all doors could be opened. Food was to be found in both goal-boxes of the Visual Discrimination T-maze and in the goalbox of the Alternation Maze. Each animal was allowed to run the T-maze three times in succession and the Alternation Maze twice.

At the age of 86 days all animals were tested for 15 days (see *Apparatus*). Each animal was tested on the Visual Discrimination T-maze for three consecutive trials daily followed one hour later by two trials on the Alternation Maze (to be referred to as Alternation Maze I). Thus each animal ran a total of 45 trials on the T-maze and 30 trials on the Alternation Maze I.

During the last three days of the additional free-environmental period (age 107 to 109 days), all animals were adapted to the Hebb-Williams elevated mazes. No maze was used, but the sideshelves of the Hebb-Williams apparatus were simply bridged by means of two 2-inch wide wooden strips. The animal was placed on the right shelf and could reach food on the opposite shelf by walking one of the two strips. Each animal was allowed three trials daily.

At the age of 110 days, all animals were tested on the elevated Hebb-Williams mazes for 10 days. Each animal was tested for two consecutive trials daily on Maze II-G and one hour later was tested on Maze II-F, resulting in a total of 40 trials for each animal.

At the age of 120 days, all animals were tested once again without adaptation on the Alternation Maze (to be referred to as Alternation Maze II) for a five-day period. The animals that had previously run a LRRL sequence now ran a RRLL sequence, while those that had run a RRLL sequence now ran a LLRR sequence. Each animal ran three trials daily in succession, thus running a total of 15 trials.

At the age of 125 days the experiment was terminated.

C. RESULTS

Apparently the 45 trials on the Visual Discrimination T-maze were not sufficient for any learning to take place for most groups, and the data on this test are therefore omitted. For all other tests, error scores were summed and are presented as means for each group in Table 1. Although the object of the study was to detect differences of error scores between the experimental groups, each experimental group was also compared with the control group for each

test by means of *t*-tests, and the significance levels of those differences are also indicated on Table 1.

TABLE 1
MEAN ERROR SCORES AND STANDARD DEVIATIONS FOR ALL GROUPS

Group	Age of free environment	Alternation Maze I		Hebb-Williams Mazes		Alternation Maze II	
		Age 86-100 days	Mean	SD	Age 110-119 days	Mean	SD
A8	30-40	23.75**	6.36	21.50**	5.12	18.62**	4.39
B8	50-60	14.88**	5.69	20.88**	3.02	13.38**	4.58
C8	70-80	30.12*	7.54	26.00*	4.69	19.00*	5.87
A1	30-40	29.62*	7.68	28.88	6.72	20.00*	4.80
B1	50-60	21.86**	4.09	23.43**	3.49	22.43	3.85
C1	70-80	42.88	12.95	30.25	4.76	27.25	6.61
Control	—	39.75	4.46	35.12	5.69	26.12	3.98

* *t*-test comparison with Control Group; $p < .05$.

** *t*-test comparison with Control Group; $p < .01$.

All eight-hour groups differ significantly from the control group, while differences with the one-hour groups were less significant and less consistent, suggesting that amount of early experience effected later performance regardless of age of exposure and in spite of later experience.

The variance around the experimental group means to detect differences between experimental groups was analyzed by means of a two-factor analysis of variance design, using age and amount of experience as the variables. Significant *F* ratios on Tables 2, 3, and 4 indicate that both age at which the animals were exposed to a free-environmental condition and the time (number of hours) spent in it affected testing performance in adulthood. Not only did those variables determine test performance in early adulthood (age 86 days), but the same factors continued to differentiate those groups after an additional free environmental period.

TABLE 2
TWO-FACTOR ANALYSIS OF VARIANCE OF THE ERROR SCORES FOR ALTERNATION MAZE I

Source	SS	df	Variance estimate	F ratio
Rows (hours)	874.33	1	874.33	12.228**
Columns (age)	2636.60	2	1318.30	18.438**
Interaction	108.98	2	54.49	0.762
Within cells	3003.00	42	71.50	
Total	6622.91	47		

** $p < .01$.

TABLE 3
TWO-FACTOR ANALYSIS OF VARIANCE OF THE ERROR SCORES FOR THE
HEBB-WILLIAMS MAZES

Source	SS	df	Variance estimate	F ratio
Rows (hours)	268.05	1	268.05	10.244**
Columns (age)	285.45	2	142.72	5.455**
Interaction within	47.84	2	23.92	0.914
Within cells	1098.96	42	26.16	
Total	1700.30	47		

** $p < .01$.

TABLE 4
TWO-FACTOR ANALYSIS OF VARIANCE OF THE ERROR SCORES FOR
ALTERNATION MAZE II

Source	SS	df	Variance estimate	F ratio
Rows (hours)	465.19	1	465.19	15.618**
Columns (age)	233.64	2	116.82	3.922*
Interaction	142.50	2	71.25	2.392
Within cells	1250.96	42	29.78	
Total	2092.29	47		

* $p < .05$.

** $p < .01$.

Comparisons of the means between the different tests show that relative level remained essentially unchanged. As a group all eight-hour groups remained superior to the one-hour groups, while for the age variable the B groups (age Days 50 to 60 of free-environmental experience) are superior to the other age groups (with the exception of the B1 group in the last test).

D. DISCUSSION

The results of this study are in general agreement with the findings of earlier investigators (3, 5, 6, 8): there appears to be little doubt that an enriched perceptual environment during the developmental period will lead to superior problem-solving behavior in mature rats when compared with rats deprived of this experience. The present study also agreed with the findings of Eingold (2) that the total developmental period can be delimited into a 10-day age-range around a mean of 55 days of age in which early experience is most effective. It appears however that the concept of the critical period, which had been perceived as an all-or-none concept, should be modified. Almost invariably adult animals learn to solve problems regardless of their earlier experiences. The difference is one of degree or rate of learning. The results of the present study substantiate the existence of a "most effective" period, but also suggest that other periods of exposure to a free-environment situation

prior to maturity may be effective when compared with subjects lacking this type of experience.

Thus Denenberg's (1) hypothesis that the critical period is strictly a function of intensity of stimulation appears to be substantiated, in that experience during the critical period is subject to degrees of duration of stimulation, thus putting some strain on the previous concept of critical periods analogous to its use in embryology: namely, that within a short time an ability will emerge in its full range.

Relatively unchanged standings between the earlier tests and the later tests (separated by a period of experience in adulthood) tend to support the irreversibility hypothesis: i.e., earlier experience is more effective than experience at maturity. Had this adult experience—which was three times the amount of the earlier experience for the eight-hour groups and 24 times that for the one-hour group—had any effect, the differences due to the early experience should have disappeared.

E. SUMMARY

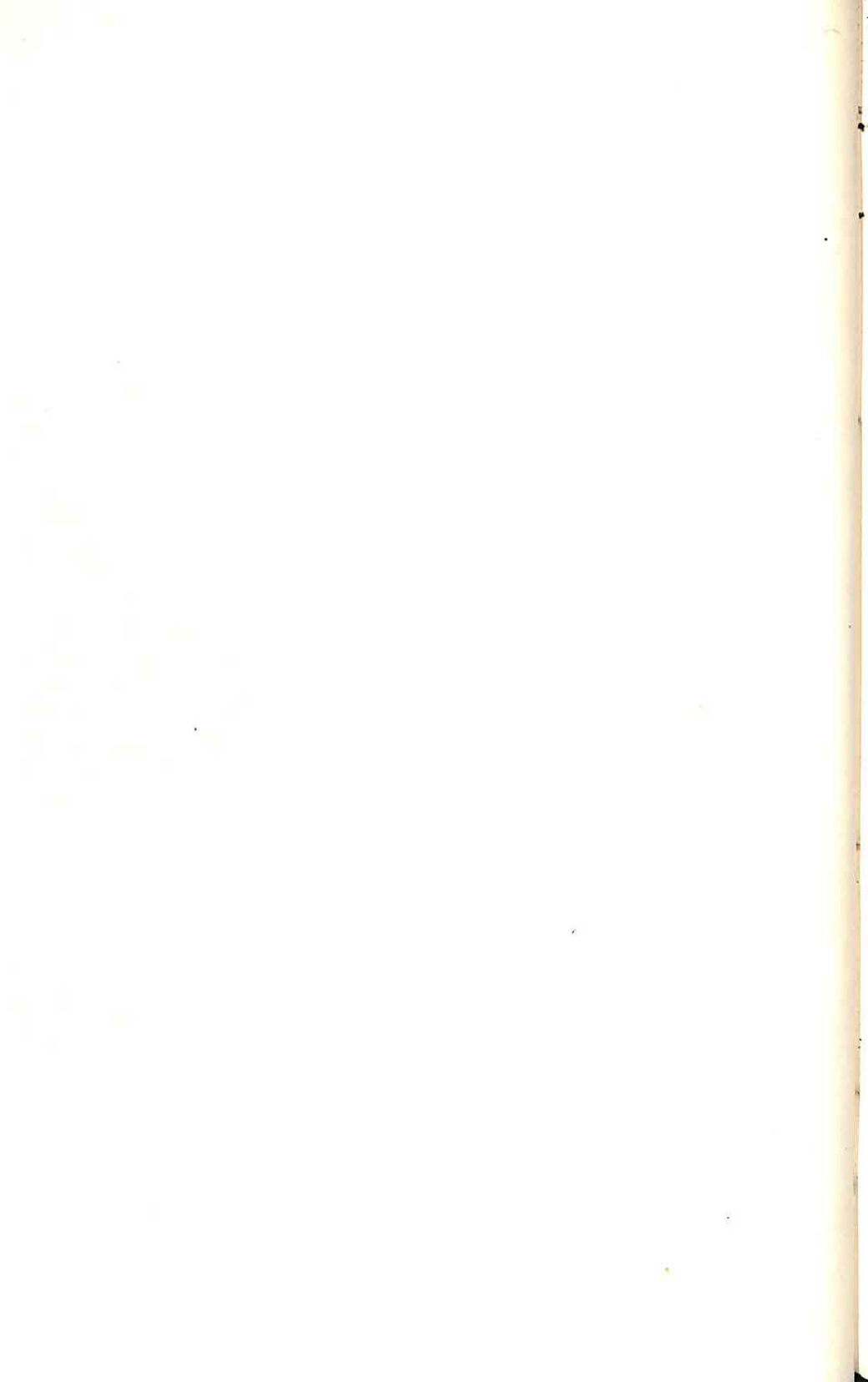
The experiment studied, in the rat, the effects of exposure to a free environment at different age periods and in different amounts upon problem-solving behavior in adulthood. It was found that for spatial discrimination learning the age period of 50 to 60 days is more effective than age periods of 30 to 40 or 70 to 80 days. It was also found that more experience is more effective than less experience and this was true for any age, including the "critical" or "most effective" period. Thus the hypothesis that more experience during a less critical age period may have results equal to that of less experience during the critical period was substantiated. Furthermore, a large amount of additional free environment experience in adulthood left the levels of performance obtained prior to this additional experience relatively unchanged.

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ANGLE SENSE IN CATS AND ANTS*

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A. INTRODUCTION

Schneirla (11) has reported that ants, forced to make a right-angle turn and then presented with a choice point, tend to make another right-angle turn, but in the opposite direction. He attributed this response to centrifugal swing, caused by the joint action of momentum and thigmotaxis. Dashiell and Bayroff (5) reported the same effect in rats, but described the physics of the phenomenon as precluding centrifugal swing. Instead, they proposed a set for forward motion which, when disturbed, was automatically compensated for by movement equal and opposite to that of the disturbance. Another explanation for the phenomenon was Hull's (9) concept of reactive inhibition—that every reaction generates a degree of inhibition of the tendency toward that reaction. This explanation was supported by the experiments of Grosslight and Ticknor (8) and Grosslight and Harrison (7), which controlled for thigmotaxis but still produced reverse turning. However, Dingle's (6) experiments with mealworm larvae cast serious doubt on the validity of reactive inhibition as the operative principle of reverse turning. He found that subsequent to a forced turn to the right, most of his experimental Ss turned left, almost as many moved straight ahead, and none turned right. In his controls, almost all Ss moved straight ahead. Apparently the experimentals were actively compensating for the right turning instead of merely inhibiting it. Also, when the distance between the forced turn and the choice point was doubled, most Ss moved straight ahead; however, when they were kept from moving—after they had negotiated the forced turn—for the same period of time it took them to crawl the doubled length to the choice point, and then were permitted to crawl to the original choice point, reverse turning was exhibited—indicating that disappearance of reverse turning was not a function of time, as predicated of reactive inhibition (9).

A set of forward motion seems to be the most plausible explanation for reverse turning that has so far been offered. An attractive adaptation of this

* Received in the Editorial Office, Provincetown, Massachusetts, on November 23, 1965. Copyright, 1967, by The Journal Press.

† The Journal Press regrets to report that Dr. Margoshes died in February, 1966.

hypothesis is suggested by Barnwell (1), who supplies strong experimental evidence that reverse turning is a kinesthetic response, probably widespread in animals. He found that "the millipede, *Trigoniulus lumbricinus*, when forced to crawl through a corridor containing an abrupt turn, tended to turn upon emergence from the corridor at an angle which was opposite and approximately equal to the angle of the forced turn" (1, p. 48).

B. METHOD

The present author replicated some of Barnwell's (1) experiments with two widely separated species, chosen on the basis of convenience—the ant and the cat. Three ants were run through a right-angle maze and three ants through a 60-degree-angle maze, once in each direction, for a total of 12 ant-maze runs. All 12 exhibited reverse turning approximately equal to the forced turn.

The author also ran two cats through a right-angle maze and the same two cats through a 60-degree-angle maze, once in each direction, for a total of four cat maze runs. Again, there was reverse turning on each occasion, but while the choice after the right-angle forced turn was a right-angle in the opposite direction, after the 60-degree angle, the choice was once again approximately a right angle, though in the opposite direction from the forced turn. One of these cats lived in the house where the experiment was performed. The maze terminated near a door she was accustomed to going through to get to her food. When she reached the end of the maze, she sat down for a while, as though torn between a desire to turn in the predicted direction and a desire to turn the other way, to the door. Finally she walked a few steps, slowly and deliberately to the left, and then quickly turned and went through the door at the right. Whatever factors were involved in Anna's movements, momentum was not one of them.

C. DISCUSSION

These experiments tend to show that reverse turning, at an angle approximately equal to a prior forced turn, appears to be a "kinesthetic orientation . . . widespread in animals" (1, p. 38), as suggested by Barnwell and demonstrated by him for millipedes.

Barnwell, who used very careful, precise quantitative methods, found that "on a statistical basis the millipedes appeared to be capable of distinguishing 10° differences in the angle of the forced turn" (1, p. 48). As he points out, "the experiments as performed did not eliminate the possibility that pervasive extra-maze factors served as spatial references for a compass reaction" (1, p. 48)—a possibility indicated by the recent studies of animal orientation as affected by

geomagnetic, electrostatic, and gamma radiation fields (2, 3, 4, 10). Nor was this factor of pervasive environmental influences controlled for in any of the work by earlier experimenters. It seems very probable that sensitivity to the geomagnetic field is the best explanation of how organisms can discriminate such fine spatial differences. This hypothesis in no way contradicts Barnwell's major finding because "such an internally controlled kinesthetic response would, of course, nicely supplement in a functional manner any externally controlled responses, including menotaxis and astrotaxis, which serve to maintain the organism on a directed course" (1, p. 48).

D. SUMMARY

The cat and the ant, when faced with a choice point subsequent to a forced turn, tend to turn at an angle equal in degrees and opposite in direction to the forced turn—behavior identical to that found in millipedes by Barnwell (1).

Previous explanations of such behavior, including centrifugal swing, a set for forward motion, and reactive inhibition appear insufficient or erroneous, and Barnwell's (1) hypothesis of a kinesthetic orientation is accepted.

It is suggested that this orientation may be mediated by organismic sensitivity to the geomagnetic field.

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ANXIETY AS A DRIVE: RECALL OF PERCEPTUALLY APPROPRIATE AND INAPPROPRIATE ITEMS*

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A. INTRODUCTION

Anxiety has been recently conceptualized as having drive properties. From this view has come the prediction that high anxiety will lead to increased interference on performance. Studies have confirmed this prediction where the tasks involved maze learning (1, 6), experimental verbal learning (2, 3), and academic performance (4). However, there have been few or no studies using a task that involved mainly perceptual materials. The purpose of this study was to test the prediction that recall of common perceptual stimuli would be poorer for high anxious Ss than for low anxious Ss.

The prediction was based on the drive theory view that the appearance of correct responses is a function of drive level interacting with the comparative strength of correct and incorrect tendencies. When correct responses are weaker than the competing incorrect ones, then the performance of high drive Ss will be impaired. In this study, it was assumed that Ss have overlearned associations between certain colors and objects. For example, there is a strong tendency to connect "yellow" and "moon," since yellow is the normally perceived color of the moon. In this experiment, such color responses will be made incorrect, while inappropriate colors (e.g., green moon) will be correct. Under this condition, competition between the experimentally correct color and the normally associated color was expected. Assuming that the normal color-object association is overlearned and hence stronger than the experimentally correct association, then high drive Ss should perform more poorly than low drive Ss. Where the experimental color is identical with the natural color of the object, no competition exists and no differences were expected between high and low drive Ss.

B. METHOD

The Taylor Manifest Anxiety Scale, MAS (5), and Sarason's General Anxiety, GA, and Test Anxiety Scales, TA, (4)¹ were administered to 49

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¹ Personal communication from I. Sarason, 1961.

students in a general psychology class. Ss were then shown 40 colored pictures of common objects in random order. For 20 of the objects (Appropriate), the colors were ones normally found associated with the objects in everyday experiences: e.g., a yellow moon. For the remaining 20 objects (Inappropriate), the colors used were those not commonly associated with the objects: e.g., a blue tomato. All objects were common objects to reduce differences in recall because of differences in familiarity. To ensure proper identification, the names of the objects and colors were announced as each picture was presented. After the series was presented, Ss wrote down the names of as many objects and their corresponding colors as they could. This was repeated for 10 trials. The number of correct appropriate and inappropriate perceptions on the last trial was used to determine the extent of acquisition. Two days later, recall was again measured and the number of appropriate and inappropriate items determined (recall scores).

C. RESULTS

1. *Acquisition*

Since differences in recall could be a function of differences in the strength of initial acquisition, comparisons between mean acquisition scores were computed. All Ss whose anxiety scores fell above the mean were considered high anxious Ss. All below the mean were regarded as low anxious Ss. Acquisition scores for the high and low anxious groups were not statistically different by *t*-test analyses. No differences were obtained when groups were separated by Taylor General or Test anxiety scores. Thus high and low anxious Ss learned the appropriate and inappropriate lists equally well.

2. *Anxiety and Recall*

It was possible to compare the recall scores for the high and low anxious Ss directly. However, such differences could be a function of individual differences in each S's acquisition of the appropriate list as opposed to the inappropriate list. For example, a high anxious S might have learned a greater number of appropriate items than inappropriate ones. Thus, his recall score might be automatically lower for inappropriate items as an artifact. To control for this, each S's recall score for appropriate items was subtracted from his acquisition score for appropriate items to give an amount-loss score. A similar procedure was used for the inappropriate items. High loss scores indicate poorer recall. The mean amount-loss score, appropriate items, for the high anxious Ss was then compared with the mean loss scores for the low anxious Ss. The same comparisons were made for the mean amount-loss

score, inappropriate items, for the high and low anxious groups. Results indicate that high anxious Ss on the MAS and TA showed poorer recall of *inappropriate* items than do low anxious Ss (t of mean difference between MAS high anxious Ss *versus* low anxious Ss = 2.40, $p = .01$; t of difference between TA groups = 2.02, $p = .02$). High anxious Ss were not found to differ from low anxious Ss on extent of recall for *appropriate* items.

D. DISCUSSION AND CONCLUSIONS

It appears that the hypothesis of the interfering nature of anxiety on performance is applicable to perceptual materials. As predicted, anxiety led to poorer recall of perceptually conflicting information but had no effect on perceptually appropriate items. However, differences between high and low anxious Ss might be the result of any of three conditions: amount of loss of inappropriate items is greater for the high anxious Ss than for the low anxious Ss because (a) High anxious Ss show a greater *decrement* in recall of inappropriate items than do low anxious Ss; the differences are therefore due to the interference of anxiety on the performance of the high anxious Ss. (b) Low anxious Ss show an *increased* recall of inappropriate items, while the high anxious Ss retain as many inappropriate as appropriate items; the differences are therefore due to the improved performance of the low anxious Ss rather than any interference from anxiety. (c) High anxious Ss show a decrement but low anxious Ss show an increment in recall of the inappropriate items.

To determine which of the above was appropriate, the amount of appropriate items that the high anxious Ss lost was compared with the number of inappropriate items that they failed to recall. The same procedure was used for the appropriate and inappropriate loss scores for the low anxious Ss. Results (t -tests of the difference between means) indicate that the high anxious Ss recalled as many appropriate items as inappropriate items. Moreover, the mean number of appropriate items and the mean number of inappropriate items recalled by the high anxious Ss were not significantly different from the mean number of appropriate items recalled by the low anxious Ss. In other words, the recall performance of the high anxious Ss for both the appropriate and inappropriate items was equivalent to the performance of the low anxious Ss for appropriate items. In addition, although the results did not reach the .05 level of significance, low anxious Ss did show a consistent tendency toward higher recall for the inappropriate items than the appropriate items ($p = .10$). The differences in performance between high and low anxious Ss might therefore be a result of the improved recall for the inappro-

priate items by the low anxious Ss rather than the poorer recall by high anxious Ss.

Thus, although anxiety is related to recall of perceptually inappropriate items, it cannot be concluded that this is due to the interference effects of anxiety on performance. High anxiety appears to be less important an influence on recall of commonplace, inconsistent perceptions than might be assumed from drive theory. There is a possibility that the presence of low anxiety is a condition that facilitates a form of reminiscence, thereby leading to improved recall.

E. SUMMARY

The study attempted to test the hypothesis that anxiety interferes with performance on perceptual tasks when incorrect, competing responses are of higher strength than the correct responses. High anxious Ss did show poorer recall than low anxious Ss on items where the learned response was in conflict with common associational tendencies. No differences were found when the items were those for which the learned response matched common associations. Further analyses of the data suggested that the differences were related to the better recall of the low anxious Ss rather than to any interference effects of high drive.

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A LONGITUDINAL INVESTIGATION OF CHANGE IN THE FACTORIAL COMPOSITION OF INTELLIGENCE WITH AGE IN YOUNG SCHOOL CHILDREN*

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A. INTRODUCTION

While most theorizers assent to Wechsler's (10) description of intelligence as a complex constellation of interacting factors, attempts to identify and define these factors have failed to result in unanimity. The dissenting conclusions found in the literature have been explained as functions of variables, such as differences in statistical technique, varying philosophical orientations that affect decisions about rotation, and the nature of the sampled population. The question of the parameters of the sampled population assumes major proportion when one recognizes that one of the integral problems in the factorial description of intelligence involves the relationship between age and factorial structure. While there are important dissenters to the thesis, it appears that changes in the factorial organization of intelligence occur as functions of increasing age and experience. In reference to this change, one might conclude from recently published factor analytic investigations that the problem is no longer whether it happens, but why it happens.

B. PROCEDURE

1. *Objectives*

The most comprehensive objective of the present investigation is the description of the factorial organization of intelligence at the age levels tested. A second important objective is to observe changes in this organization as they occur when the same subjects are measured repeatedly.

2. *Subjects*

The original experimental group (7) consisted of 163 white children selected from three counties in Georgia representative of small rural, medium, and large industrial urban populations. At the time of the initial testing, during the summer preceding their admission to the first grade in 1961, their

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mean age was 6 years, 2 months and the mean Wechsler Intelligence Scale for Children (WISC) Full Scale *IQ* was 103. The subjects still available were retested at the end of the first grade in 1962 and again at the end of the third grade in 1964. A total of 125 subjects completed all three phases of the program. One important argument for selecting this age range inheres in the fact that there are no other known factor analytic WISC studies at the pre-school level. Also, it seems reasonable to expect pronounced developmental changes psychologically in an age range in which profound physical changes occur.

3. *Test Battery*

The test battery administered in each phase included the Wechsler Intelligence Scale for Children (9), the Peabody Picture Vocabulary Test (4), the Ammons Full Range Picture Vocabulary Test (1), and two reference tests. Prior to statistical analysis each WISC subtest except Coding was split into two, three, or four parts, to which individual subtest items were assigned by simple rotation. This operation resulted in 26 WISC variables that combined with the four tests mentioned previously to form a 30-variable intercorrelation matrix.¹ The creation of additional variables by the modification provided the design with the capability of establishing more than the traditional number of dimensions identified in most Wechsler analyses, but it does not force this result. The resulting data were factor analyzed and rotated to Kaiser's varimax criterion (5). Tucker's (8) congruence coefficients were computed between all factors, thereby facilitating the matching of factors.

C. RESULTS

Eight factors were extracted from the 1961 testing. Ten factors were extracted for the 1962 data and nine for the 1964 data. In 1961, one of the factors was identified by its high loadings on Manipulation of Areas and in 1962 one of the factors was identified by its high loading on Number Concepts. Since each of these is a "nonWechsler" reference-variable factor, and since each appears in only one of the three analyses, they are not treated in this paper nor do they appear in the table. A factor loading of .40 is accepted as the significance criterion. However factor loadings of greater than .30 are accepted as significant when other splits from the same subtest also load significantly on a given factor. The presence of the stronger loading constitutes evidence that a somewhat weaker loading on another split of the same subtest

¹ Tables of intercorrelations and factor matrices are available without charge upon application to the senior author.

may be more than an artifact. Note that five factors are "continuous": i.e., they are identifiable in the preschool analysis and persist in each succeeding analysis. Obviously these lend themselves most easily to interpretation.

Factor A: Expressive Psycholinguistic. Loadings for this factor are shown in Table 1. This is clearly the "Verbal" factor inevitably found in Wechsler analyses. The designation is borrowed from C. E. Meyers (6), who uses it to discriminate between the receptive and the expressive use of language. The consistent Information and Vocabulary loadings suggest verbal facility or fluency rather than the application of judgment to new situations. The relation of the Comprehension subtest to factor A is enigmatic. In 1961 and 1964 it forms the nucleus of a separate factor, while it combines with factor A in 1962. This question will receive more extensive treatment when factors H, I, J, and K are discussed. Factor A appears to place a premium on verbally retained knowledge. The increased loading of Information on factor A in 1964 may be a reflection of the impact of formal education.

TABLE 1
WISC AND REFERENCE TEST VARIABLES WITH SIGNIFICANT LOADINGS ON
FACTOR A, EXPRESSIVE PSYCHOLINGUISTICS

Test	Preschool	First grade	Third grade
	1961	1962	1964
Vocabulary I	69	61	59
Vocabulary II	41	70	69
Vocabulary III	64	63	39
Vocabulary IV	66	63	63
Information I	—	—	65
Information II	45	45	74
Information III	32	—	64
Comprehension I	—	61	—
Comprehension II	—	61	—
Comprehension III	—	47	—
Similarities I	—	—	69
Similarities II	—	—	60
Peabody Picture Vocabulary	61	53	67
Ammons Full-Range Picture Vocabulary	71	59	57

Factor B: Perceptual Organization. This factor (see Table 2) is most readily identified by its consistently high loadings for Block Design. It is like factor A in that a similar factor is systematically identified in Wechsler analyses. Wechsler (10) states that its main determinant involves the capacity to organize discrete spatially perceived units into larger wholes or configurations. Both in the visualization of outcome and in the manipulation of test material, speed is rewarded. It may be noted that the loadings for Object Assembly tend to reduce with increasing age. As a matter of fact, Object

Assembly I does not load significantly on factor B in 1964. More will be said about this trend in the treatment of factor K.

TABLE 2
WISC AND REFERENCE TEST VARIABLES WITH SIGNIFICANT LOADINGS ON
FACTOR B, PERCEPTUAL ORGANIZATION

Test	Preschool	First grade	Third grade
	1961	1962	1964
Block Design I	79	82	80
Block Design II	78	77	83
Object Assembly I	68	46	—
Object Assembly II	57	58	44
Arithmetic I	—	—	38
Arithmetic II	—	—	52
Digit Span-Backward	42	—	—
Number Concepts	—	—	58

Factor C: Numerical Ability. This factor has appeared repeatedly in previous factorial studies. In his factor analysis of the WISC standardization data, Cohen (3) identified a similar factor at the 13-6 age level by its significant loadings on the Arithmetic and Digit Span subtests. The factor has frequently been identified as a "Memory" or "Freedom from distractibility" factor, and certainly with good reason. "Numerical Ability" was selected in the present study because of the relationship of the Information subtest to factor C. Note in Table 3 that in both 1961 and 1962 Information I loaded strongly on this factor. The items assigned to the Information I split are (a) How many ears have you? (b) From what animal do we get milk? (c) How many pennies make a nickel? (d) How many things make a dozen? It seems likely that the common element running through each of the tests loading on this factor is content involving numbers. We are also confronted with a demonstration that item content, as well as item form, had considerable explanatory value in Wechsler tests.

TABLE 3
WISC VARIABLES WITH SIGNIFICANT LOADINGS ON FACTOR C, NUMERICAL ABILITY

Test	Preschool	First grade	Third grade
	1961	1962	1964
Arithmetic I	39	68	41
Arithmetic II	61	56	39
Digit Span-Forward	73	—	46
Digit Span-Backward	42	—	77
Information I	59	74	—
Information II	—	42	—

Factor D: Perception of Incongruity. Factor D loadings are shown in Table 4. This factor derives its identity from its consistent Picture Completion loadings. In his analysis of the WAIS performance at four adult age levels, Cohen (2) found that most of the Picture Completion variance was accounted for by a quasispecific factor which he declined to interpret. Certainly its authenticity is attested by this study. The basic task of Picture Completion is the differentiation of essential from nonessential details. Since failure on Picture Completion is frequently a result of inappropriateness rather than lack of response, Wechsler (10) provisionally describes this factor as a *relevance* factor. Thus, factor D can be identified in the preschool analysis and seems to be well stabilized in the 9-year-old subject.

TABLE 4
WISC AND REFERENCE TEST VARIABLES WITH SIGNIFICANT LOADINGS ON
FACTOR D, PERCEPTION OF INCONGRUITY

Test	Preschool	First grade	Third grade
	1961	1962	1964
Picture Completion I	55	60	73
Picture Completion II	60	56	59
Picture Completion III	75	73	38
Object Assembly II	41	—	—
Number Concepts	45	—	—
Similarities II	—	—	41

Factor E: Eduction of Conceptual Relations. Cohen (3) found that Picture Arrangement loaded on a factor that he declined to interpret at ages 10-6 and 13-6. The present study reinforces his findings that Picture Arrangement cannot be accounted for in terms of a general "Perceptual Organization" or "Performance" factor. Note in Table 5 that, while Digit Span-Backwards disappears from this factor in 1964, its presence in two of three analyses may contribute to the psychological meaningfulness of the factor. It may well be that the common element is sequence. Certainly the ability to give order to a series of discrete events is an important element in reasoning.

TABLE 5
WISC VARIABLES WITH SIGNIFICANT LOADINGS ON FACTOR E,
EDUCATION OF CONCEPTUAL RELATIONS

Test	Preschool	First grade	Third grade
	1961	1962	1964
Picture Arrangement I	80	61	83
Picture Arrangement II	78	57	57
Digit Span-Backward	43	68	—

While factors A through E are not free of interpretive difficulty, it is fair to point out that the interpretation of the remaining factors is considerably more perplexing than theirs. The remaining factors are noncontinuous in the sense that they failed to appear in all three analyses. Some of them are suggestive and induce one to generate hypotheses. Others are bewildering.

Factor F: Verbal Concept Formation. This factor (see Table 6) is identified by its strong Similarities loading in 1961, which becomes exclusive in 1962. Both splits load decisively on the Expressive Psycholinguistics factor in 1964. The only other substantial loadings for this subtest are on the Picture Completion factor, where Similarities I has a loading of .27 and Similarities II of .41. While what these tests have in common is not apparent, it is interesting that Cohen (2) observed a tendency for the two to load on common factors in his WAIS analysis. It could be said of factor F that the 1964 results tend to confirm the findings of numerous factorial studies but not those of the present writers. Further theorizing with the data at hand would probably not prove helpful. The behavior of the Similarities subtest in the 1966 analysis will be viewed with genuine interest.

Factor G: Perceptual Speed. After the 1962 analysis in which Coding loaded exclusively and heavily on a unique factor (Table 6), it was felt that a new factor might be emerging. The 1964 results confirm this prediction. The fact that the increase in the age of the subjects resulted in the administration of a nonfamiliar advanced form in 1964 strengthens the interpretation. The basic task involves the association of certain symbols with certain other symbols. The score is a function of the speed with which the subject is able to do this. The identification of a Coding factor concurs with the findings of Cohen (2), who observed that the Digit Symbol subtest loaded exclusively on a specific factor at all four adult age levels. The inverse relationship between Coding and Arithmetic I is perplexing. In that there

TABLE 6
WISC VARIABLES WITH SIGNIFICANT LOADINGS ON FACTOR F, VERBAL CONCEPT
FORMATION, AND FACTOR G, PERCEPTUAL SPEED

Test	Preschool		First grade		Third grade	
	1961		1962		1964	
	F	G	F	G	F	G
Similarities I	65	—	80	—	—	—
Similarities II	63	—	74	—	—	—
Information III	62	—	—	—	—	—
Arithmetic I	51	—	—	—	—	48
Coding A	58	—	—	83	—	—
Coding B	—	—	—	—	—	82

is no frame of reference for interpretation, the most expedient recourse is to dismiss it as a statistical artifact.

Factors H, I, J, and K. The writers propose to discuss these factors collectively because they all share some relationship, albeit obscure, to the Comprehension subtest. Factor H loadings are listed in Table 7. Factor H is relatively straightforward and can be identified as a Comprehension factor. The main operation seems to be the evaluation of past experience in making judgment about new situations. The chief interpretive problem presented by factor H stems from its absence in 1962 when Comprehension loads on the Linguistic factor. In his WISC analysis, Cohen (3) also observed the motility of the Comprehension subtest between the clear-cut Verbal factor and a second factor identified by its loading on Comprehension, Vocabulary, and Picture Completion. This factor and the 1964 factor H are almost identical. This constitutes a strong argument for the authenticity of the factor in spite of the divergent results in 1962.

TABLE 7
WISC VARIABLES WITH SIGNIFICANT LOADINGS ON FACTOR H,
EVALUATION OF PAST EXPERIENCE

Test	Preschool	First grade	Third grade
	1961	1962	1964
Information I	30	—	—
Information II	44	—	—
Comprehension I	57	—	60
Comprehension II	50	—	68
Comprehension III	59	—	—
Vocabulary I	—	—	37
Vocabulary II	—	—	30
Vocabulary III	—	—	32
Picture Completion II	48	—	41

Factors I, J, and K. These factors are even more difficult to interpret than factor H. Viewed comprehensively (see Table 8) they do point up the independent, if not capricious, behavior of Comprehension III. Note that both factor I in 1962 and factor K in 1964 have strong inverse loadings for Comprehension III and Manipulation of Areas. This result, while consistent, does not yield to attempts at explanation. In 1962, Comprehension loads on still another factor, J, and again its bedfellows fail to contribute to its meaningfulness. The behavior of the Comprehension subtest supports two conclusions: (a) Comprehension is among the most factorially complex subtests; and (b) item content may be more important than item form in accounting for its variability. The fact that Comprehension III separates from

the other Comprehension splits in 1964 provides an example of this. Comprehension III items involve the proper course of behavior if the grocer runs out of bread, the advantages in building a house of brick rather than wood, the advantages of paying bills by check rather than cash, and the merits of cotton fiber in making cloth. While the items in each split were assigned by simple rotation, it appears that these particular items have a unique element. They are uniformly devoid of the interpersonal quality which is apparent in most of the remaining items. The interpersonal content is exemplified by items like "What is the thing to do if a fellow much smaller than yourself starts to fight with you?" or "Why should a promise be kept?" A quote from Wechsler's *Adult Intelligence* (10) seems appropriate. In writing of the Comprehension test he observes, "Even more suggestive are certain capacities which, though as yet not actually demonstrated factorially, seem on the basis of clinical experience to influence performance on this test. One of these is a 'factor' that might be termed 'social stereotypy'; another, 'common sense judgment.' But here again one must await further analysis to substantiate these clinical hunches" (10, p. 130). The behavior of Comprehension in the present investigation may well constitute a substantiation of his informed hunch.

TABLE 8
WISC AND REFERENCE TEST VARIABLES WITH SIGNIFICANT LOADINGS ON
UNNAMED FACTORS I, J, AND K

Test	Preschool 1961			First grade 1962			Third grade 1964		
	I	J	K	I	J	K	I	J	K
Information III	—	—	—	—72	—	—	—	—	—
Comprehension III	—	—	—	34	60	—	—	—	78
Digit Span-Forward	—	—	—	—	74	—	—	—	—
Object Assembly I	—	—	—	—	-37	—	—	—	—
Manipulation of Areas	—	—	—	-61	—	—	—	—	-53

Factor L: Visualization. While this is a complex factor (see Table 9), it may derive its identity from its loading of both Object Assembly splits. The observation has already been made that Object Assembly tends to reduce its loadings on the Perceptual Organization factor with increasing age. In 1964, one of the Object Assembly splits leaves this factor entirely. The tentative interpretation is that factor L represents an emerging factor that may increase in strength and definition with age. Perhaps the most basic difference between Block Design and Object Assembly is that Block Design requires the reproduction of a geometrical pattern provided by the examiner, while Object

Assembly requires that the subject visualizes the finished product using only the cues supplied by inductive process.

TABLE 9
WISC VARIABLES WITH SIGNIFICANT LOADINGS ON FACTOR L, VISUALIZATION

Test	Preschool 1961	First grade 1962	Third grade 1964
Picture Completion III	—	—	54
Vocabulary III	—	—	55
Object Assembly I	—	—	68
Object Assembly II	—	—	34

D. SUMMARY AND CONCLUSIONS

1. The results of the present study are generally consistent with prior factor studies of the Wechsler. The greater number of factors identified is the function of methodology that permits, but does not force, this outcome. This investigation is important in that it confirms the existence of stable mental factors at the preschool level.

2. The investigation resulted in the tentative identification of two emergent factors. This is interpreted as qualified support for the hypothesis that intelligence tends to differentiate with increasing age and experience. The ambiguous nature of the evidence is characterized by the Concept Formation factor that appears to have undergone a process of consolidation.

3. The results suggest greater factorial specificity than has frequently been imputed to the Wechsler subtests. It would appear that the criticism of the clinical interpretation of the Wechsler psychogram on the basis of the factorial complexity of the subtests may be overestimated.

4. The results suggest that item content is an important determinant in factorial structure of the Wechsler. To the extent that the factorial complexity of a given subtest is determined by content, attempts to rank subtest items in terms of "absolute level of difficulty" will yield dissenting results as a function of the population sampled. The independent behavior of the Comprehension III split and the loading of the Information I split on a numerical ability factor provide good illustrations of the importance of item content.

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NEOSTRIATAL AND HIPPOCAMPAL FUNCTIONS IN THE BEHAVIOR VARIABILITY OF THE CHICK*¹

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A. INTRODUCTION

In conjunction with his work on the effect of cortical injuries upon the learning capacity of the organism, Lashley (5) developed his principle of equipotentiality. According to Lashley (5, p. 123), equal performance decrements are effected by diverse lesions in any part of a functional area. Within limits Lashley's principle has gained some acceptance since 1929; more recently the work of several investigators has lent itself to an indirect examination of this principle on a grosser telencephalic level. Isaacson and Wickelgren (2) and Wickelgren and Isaacson (11) studied rats with subcortical lesions of the telencephalon and found that their Ss failed to adapt to an introduction of novel external cues and that they adhered to previously established responses. Kimble (4) has reported repetitive behavior in rats with hippocampal lesions in an open-field situation and in Hebb-Williams maze running, and deficits in passive avoidance behavior with both hippocampal and cortical lesions. Similar types of perseverative behavior with varieties of subcortical lesions were observed in studies conducted with cats [see Kaada, Rasmussen, and Kvien (3); and McCleary (6)]. Roberts, Dember, and Brodwick (7), using spontaneous alternation and locomotor exploration tasks, reported that rats with hippocampal ablations alternate less and show less habituation with task familiarization than do normal rats. The above studies suggest the overall presence of some sort of rigidity and impairment of new learning with telencephalic ablation rather than or together with specific task impairments related to specific *loci* of lesions. These interesting findings, related to Lashley's earlier principle, raised two other problems worthy of investigation: namely, (a) do these findings apply to other species in the same fashion, and (b) if they do apply, then what effect do such ablations have upon the learning capacities of a different species?

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Therefore, a different and until now untested species—namely, chicks—was selected for this study, and the following two hypotheses were tested:

1. In tasks permitting divergent responses to external stimulus conditions that ordinarily evoke median responses on the part of normal Ss, experimental Ss with neostriatal and hippocampal ablations will exhibit a greater range of response from the mean than will normal Ss. This prediction is based upon the observed tendencies of experimental Ss in the earlier cited studies to react in an extreme rigid fashion without relating their behavior to the complex properties of external stimuli.

2. Chicks with hippocampal ablations will show a higher degree of extremeness in their responses through the accentuation of a particular tendency during the process of task familiarization than will neostriatal (cerebral control) or normal chicks. The findings here would tend to support or reject the idea of Roberts, Dember, and Brodwick (7) concerning the specific effects of hippocampal ablations with task familiarization.

B. METHOD

1. *Subjects*

Twenty-six White Rock chicks served as Ss and they were divided into three groups as follows: nine hippocampal, eight neostriatal (cerebral control), and nine normal.

Surgery was performed under ether anesthesia on either the third or fourth day after hatching. A median block of telencephalic tissue with its greatest cross-sectional area, 4 mm deep and 3 mm wide, at a position .5 mm posterior to the anterior commissure [using the reference coordinates of van Tienhoven and Juhasz (10)] was aspirated from each hippocampal S through a dorsal opening in the skull. In length the ablation extended 2.7 mm anteriorly and posteriorly, tapering to cross-sectional areas 1.5 mm deep and 2.5 mm wide. Two lateral blocks of tissue with their greatest cross-sectional areas, 2.5 mm deep and 3.5 mm wide, at a position .77 mm posterior to the anterior commissure, were aspirated from each cerebral control S. The median edges of these ablations were 1.5 mm from the midline. In length the ablations extended 2.7 mm anteriorly and posteriorly, tapering to cross-sectional areas 1.1 mm deep and 2.5 mm wide. Wounds were sutured and allowed to heal for the testing session on the seventh day. Normal Ss underwent no surgery. On the eighth day after hatching, all three groups of Ss were sacrificed and their brains preserved in 10 per cent formalin. The hardened brains were cut in 2 mm sections for review. Three cross-sectional camera-lucida drawings were

made from the anterior, middle, and posterior areas of the ablations for representative hippocampal, cerebral control, and normal Ss. The drawings are shown in Figure 1. Median ablations resulted in 85 to 90 per cent destruction of the rudimentary hippocampal formation. Lateral ablations primarily involved the destruction of neostriatal tissue.

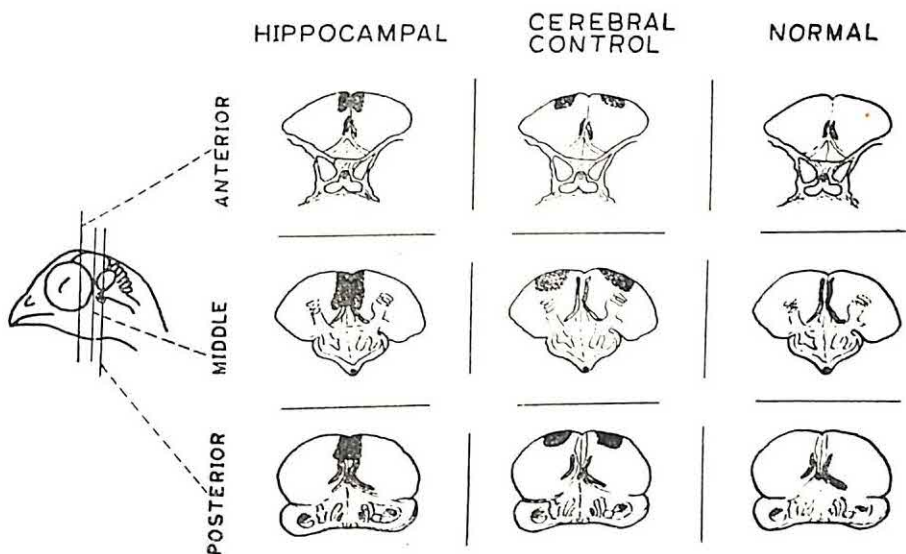


FIGURE 1

CAMERA-LUCIDA DRAWINGS OF CROSS-SECTIONS OF REPRESENTATIVE HIPPOCAMPAL, CEREBRAL CONTROL, AND NORMAL Ss TO SHOW LOCATION AND EXTENT OF ABLATIONS. Shaded areas indicate lesions.

2. Apparatus

The apparatus, constructed of $\frac{1}{4}$ -inch plywood, consisted of a supporting framework enclosing two compartment-like shelves at different levels. The upper shelf was stationary and completely enclosed except for its center side which faced the lower shelf. A $1\frac{1}{2}$ -quart, plastic, translucent container was inverted and inserted through an opening in the top of the upper shelf. It was equipped with a hinge-top through which the S was dropped into position for the start of each trial. A red mark on the container faced the open side of the shelf and could serve as an orientational cue. At the start of each trial the container was lifted out, freeing the chick on the upper shelf, and a flap was shut over the opening in the top of the upper shelf. This shelf was painted a dull black except for a $\frac{3}{8}$ -inch square, white-streaked strip of wood on the center edge of the floor. The strip was used to aid the chick in discriminating

the edge of the shelf and in clinging to it. The lower shelf was moveable vertically and open top and center. It could be adjusted by $1\frac{1}{2}$ -inch intervals from a distance of 3 inches to 27 inches below the upper shelf. The enclosing sides around this shelf as well as the remainder of the supporting framework

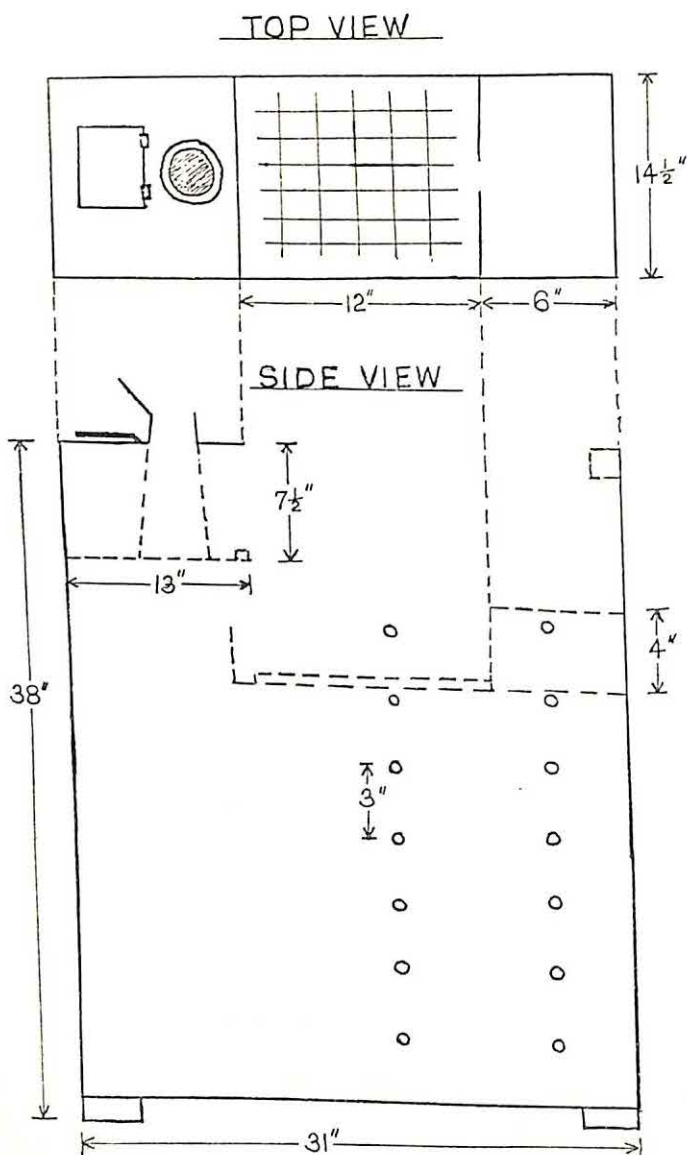


FIGURE 2
JUMPING APPARATUS EMPLOYED IN APPROACH-AVOIDANCE AND ATTENTION TASKS⁵

were left unpainted. A cardboard box with a transparent top and a $3 \times 3\frac{1}{2}$ -inch opening to allow entrance was placed lengthwise on the far side (away from center) of the lower shelf. A checkered (1-inch square pattern) sponge surface (12 inches square) was located in front of the box; the Ss jumped to this surface. It provided depth cues and served as a cushion for jumps. There was no horizontal space between the shelves. A diagram of the apparatus is shown in Figure 2.

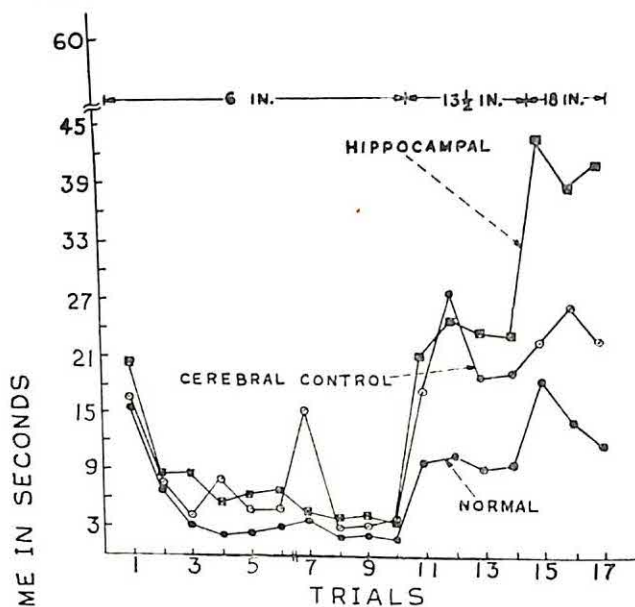
The testing room was free from auditory stimuli and darkened except for a 60-watt bulb placed one foot above the apparatus.

3. Procedure

Test 1 was an approach-avoidance task consisting of 17 trials and designed for testing the Ss in groups of four. Before beginning the series of trials, a group of four Ss was placed in the box (goal box) on the lower shelf for an eight-minute period with a few grains of feed scattered over the floor. (This initial use of feed served to keep the group of Ss from wandering from the goal box during the testing sessions.) The first trial of Test 1 was initiated by removing one of the Ss from the goal box and placing it in the upper shelf container. The lower shelf was located six inches below the upper shelf. At $t = 20$ seconds two taps were made on the top of the container by the experimenter, and at $t = 25$ seconds the S was released. The time between the release of the S and the contact of its feet with the sponge surface area of the lower shelf was recorded. The S entered the goal box of its own accord after jumping. The S was prodded if no jump had been made in 60 seconds—maximum latency for any one trial. Each member of the group of four Ss was tested in turn to complete trial 1. (The rotational order for all 26 Ss was such that Ss from all groups—hippocampal, cerebral control, and normal—occupied all positions in the order an equal number of times.) The intertrial interval was approximately six minutes. After six identical trials, the Ss were given a two- to three-hour rest period before testing was resumed with the seventh trial. During this session there were 11 more trials. The distance jumped was increased to $13\frac{1}{2}$ inches for the eleventh trial (counting from the first trial, first session) and retained there until the fifteenth trial when it was further increased to 18 inches for the remainder of the trials and completion of Test 1.

Test 2 was an attention task in which individual trials were conducted as in Test 1. Test 2 followed Test 1 after a two- to three-hour rest period and consisted of 12 trials with the lower shelf located $13\frac{1}{2}$ to $16\frac{1}{2}$ inches below the upper shelf. This height was regulated and fixed somewhere in the $13\frac{1}{2}$ -

APPROACH-AVOIDANCE TASK



ATTENTION TASK

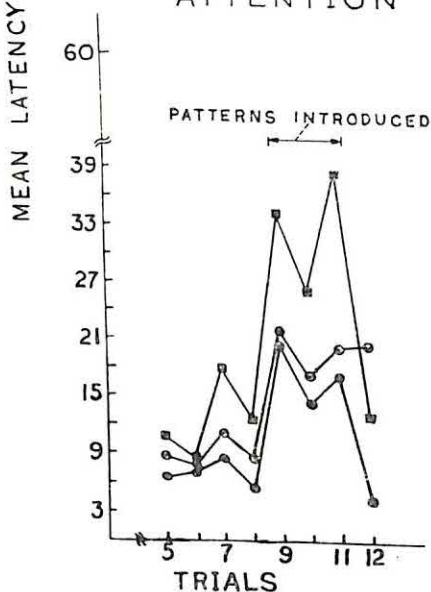


FIGURE 3

MEAN RESPONSE LATENCIES OF CHICKS IN HIPPOCAMPAL, CEREBRAL CONTROL, AND NORMAL GROUPS ON INDIVIDUAL TRIALS OF APPROACH-AVOIDANCE AND ATTENTION TASKS

to 16½-inch range during the first four trials of the series in an attempt to equalize all the groups of four Ss in their jumping habits (as regards latency), since height was no longer the variable manipulated. Circle, X, and dot patterns on 8½- × 11-inch white paper were placed on the sponge surface jumping area for trials 9, 10, and 11 respectively.

Trials 11 to 17 of Test 1 and trials 9 to 11 of Test 2 were considered critical test trials. Other trials were used as accustoming trials and were not considered part of the test proper. All trials of both tests were completed in one day.

C. RESULTS

Mean jumping latencies for the hippocampal, cerebral control, and normal groups for all trials of both tests are plotted in Figure 3. Regulatory trials 1 to 4 of Test 2 are not included. None of the differences between group means is significant. Variances and *F* ratios for the three groups on critical trials are presented in Table 1. *F* ratios that yield values exceeding the .01 level of significance are also indicated in Table 1. In seven out of 10 critical trials, both hippocampal and cerebral control variances are significantly greater ($p < .01$) than normal variances.³ No significant differences were found between hippocampal and cerebral control variances. Individual ablated chicks deviated from the group mean to a significantly greater degree on critical trials than did normal chicks, and in both directions.

The combined totals of maximum and minimum latency responses during the critical trials for hippocampal, cerebral control, and normal groups were 28, 20, and 6 respectively. In addition there were three hippocampal Ss and one cerebral control S that made no response on the regulatory trials (indicated above) and which were eliminated from subsequent testing. This data gives cursory evidence that a disproportionate number of ablated chicks were at the extremes of the response range on critical trials. The Moses Test of Extreme Reactions [see Siegel (8, p. 145)] was used and probability values computed are shown in Table 2. Both hippocampal and cerebral control groups manifested tendencies toward extreme responses, but only the hippocampal group did so significantly, a tendency which expressed itself more manifestly as trials progressed.

Variances for the three groups, hippocampal, cerebral control, and normal, on noncritical trials are not significantly different.

³ The *N* used in the computation of means, variances, and *F* ratios for hippocampal and cerebral control groups on Test 2 was reduced by 3 and 1, respectively, because these Ss were eliminated from further testing when they made no jumps in the allotted 60 seconds on all four of the regulatory trials.

TABLE 1
F RATIOS IN TESTS OF HOMOGENEITY OF SAMPLE VARIANCES FOR HIPPOCAMPAL, CEREBRAL
CONTROL, AND NORMAL CHICKS ON CRITICAL TRIALS OF APPROACH-AVOIDANCE AND ATTENTION TASKS

Test groups compared	df	Trials							Trials		
		Approach-avoidance task							Attention task		
		11	12	13	14	15	16	17	9	10	11
Hippocampal and Cerebral Control	8 ₇	1.19	1.30	1.06	1.04	1.10	1.06	1.51	1.01	1.24	3.43
Hippocampal and Normal	8 ₈	15.43**	12.10**	9.33**	13.56**	1.48	5.58**	7.61**	1.20	6.89**	4.37*
Cerebral Control and Normal	7 ₈	18.44**	15.73**	9.90**	14.08**	1.35	5.93*	5.05*	1.21	5.55*	1.27

* Significant at .05 level of confidence.

** Significant at .01 level of confidence.

TABLE 2
MOSES' TEST VALUES FOR HIPPOCAMPAL AND CEREBRAL CONTROL GROUPS ON CRITICAL
TRIALS OF APPROACH-AVOIDANCE AND ATTENTION TASKS

Ablated groups		Trials							Trials		
		Approach-avoidance task							Attention task		
		11	12	13	14	15	16	17	9	10	11
Cerebral control	.235	.235	.235	.109	.327	.420	.235	.626	.172	.626	.420
Hippocampal	.409	.125	.125	.173	.500	.125	.173	.025*	.318	.004*	.077**

* Significant at $\chi = .05$.

** Approaching the significance at $\chi = .05$.

D. DISCUSSION

Variances for the responses of chicks with bilateral neostriatal or hippocampal ablations of the telencephalon are greater than those for normal chicks in tasks that permit divergent responses to external stimulus conditions that ordinarily evoke median responses on the part of normal chicks. No difference in the means of responses of any groups was obtained because of the opposite direction of responses taken by telencephalically ablated chicks in comparison with the middle responses of normal chicks.

Brush, Mishkin, and Rosvold (1), in experiments on multiple object discrimination learning, found that monkeys with frontal lesions had abnormal difficulty in overcoming spontaneous and experimentally induced object preferences and aversions. Thompson and Malin (9) found that rats with bilateral anterior cortical lesions showed negative savings for a position habit to a *nonpreferred* side established before operation. Lack of ability to compound spatial and visual stimuli into distinctive neural patterns is an interpretation offered by the authors for this finding. Kimble (4) has reported that perseverative behavior in rats following hippocampal ablation varies directly with the difficulty of the test situation. In conjunction with these studies, the present one suggests the presence of a telencephalic system that integrates and compounds a stimulus complex and allows for an oscillation and competition of response tendencies. The interruption of this system results in "spontaneous" responding in accordance with dominant tendencies, preferences, or aversions. If the identical means for latency of responses of all groups (hippocampal, cerebral control, and normal) in the present study can validly be considered the environmental mean as determined by external cues, then the greater deviations from the mean of the responses of chicks, in which an organizational unity of the telencephalon has been disrupted by neostriatal or hippocampal lesions, can be regarded as expressions of more salient or stable organismic tendencies. The findings of the present study give support to the first hypothesis concerning the rigidity of responses of hippocampal and neostriatal chicks. The extreme rigidity observed seems best understood on the basis of the more general explanation that certain telencephalic ablations, though anatomically distinct, have the general effect of enhancing remote organismic tendencies to respond in consequence of the reduced effectiveness of the total pattern of proximate external cues to modify behavior.

The fact that earlier cited passive avoidance studies found differences in mean scores is probably attributable to task differences. Earlier studies typically employed long training series creating strong approach tendencies. In the

present study the shorter training series more likely permitted equal chances for either approach or avoidance tendencies to emerge in individual ablated Ss.

With hippocampal lesions, chicks exhibit an increasing extremeness of response with trial progression. The greater accentuation of extreme response tendencies by hippocampal Ss supports the second hypothesis proposed and is in essential agreement with the findings of other investigators [see Roberts, Dember, and Brodwick (7)] using a different species.

E. SUMMARY

Twenty-six chicks (nine hippocampal, eight neostriatal-control, and nine normal) were tested in approach-avoidance and attention jumping tasks. A specially designed jumping stand was used in this experiment. The latencies of response served as dependent variable in both tasks. The responses of individual hippocampal and neostriatal chicks deviated from the group mean (the same for all three groups) to a greater extent than did those of normal chicks. Hippocampal chicks showed an extremeness of response with trial progression. The results were interpreted as indicative of predominance of approach or avoidance tendencies produced by hippocampal or neostriatal ablations. Hippocampal and neostriatal chicks responded in an "all-or-none" manner.

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THE CONCEPT OF DEATH IN CHILDREN*

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A. INTRODUCTION

Freud has hypothesized that "the goal of all life is death" (1, p. 70). In Jungian theory we find a similar idea (4, p. 64). Personality is constantly seeking a perfect balance. Only in death can this perfect entropy, toward which the organism has been striving, be achieved. Jung theorizes that the second half of life is dominated by the individual's attitudes toward death.

Yet this idea seems quite alien to the popular attitude toward death. Most people fear death as an unknown and even avoid talking about it. Psychology, while admitting of death's great importance as a motivating force in life, has not sufficiently studied attitudes concerning this subject.

The idea of death has always posed the eternal mystery that is the core of our most important religious and philosophical systems of thought. In Christianity, the meaning of life is consummated in its termination. The Christian who longs for death shows by his desire to be with God a full understanding of his faith. As a rational being, man can grasp the inevitability of death and the concept of a future. Having accepted this fact, it seems reasonable that death should be a factor in determining his behavior, as actions are determined by expectations for the future as well as the past. Yet, the majority of people fail to confront wholeheartedly the fact of their personal death and thus fail to gain the complete understanding of life.

Man can perceive death in two manners: (a) death is treated as an end in itself, a like process for all living organisms including man; or (b) one perceives death in man as being unlike that of other organisms in that man's soul lives on after death. The man who subscribes to the former definition can justify an "eat, drink, and be merry" attitude. Life is lived for life itself, with no felt need for self-denial or human fellowship. The latter definition demands that man prepare himself in this life for the afterlife. As with any extremes, the majority of people fall somewhere in between. The attractions of the material world are sufficiently appealing that few people forsake all of them for an ascetic life devoted to preparation for eternity. Similarly, there would be a

* Received in the Editorial Office, Provincetown, Massachusetts, on December 1, 1965. Copyright, 1967, by The Journal Press.

complete breakdown of law and order in society if all people lived by a "tooth and fang" existence.

It may be argued that man can be much happier if he can treat life as a time to be spent in satisfying all carnal desires with no thought of their consequence in eternity. Life would be respected for itself and lovingly protected. But life in this simple context would appear pointless. There would seem no justification for the day-to-day struggle for existence. Primitive cultures have demonstrated this need by inventing any number of "superior beings" to which they can motivate their lives. It is this "hope" for a better existence, a reward for a life well directed, that protects man from accepting the absurdity of life for life itself.

Death, then, should be an anticipated step on the way to eternal reward. Yet, while man must admit the inevitability of death, he does not normally include death in his conscious plans until it comes so close it has to be considered.

Freud's theories have indicated that death is an unconscious motivating force on life, if not a conscious one. Death symbolism plays an important part in dream analysis, indicating that the unconscious contains death wishes, repulsive in conscious consideration, against beloved persons.

It seems practically impossible for a person to comprehend fully his own personal death. Fromm has observed that our era simply denies death (2, p. 244). It seems a matter of bad taste even to mention it. Death is passed off as a morbid topic to be ignored if at all possible.

When a person actively contemplates his own death, it is usually as a solution to real or imagined life problems. He rationalizes that death will provide things he has not been able to obtain in life, such as love and affection. When social pressures become overbearing, he may project his death and derive much satisfaction from such thoughts as, "they'll be sorry after I'm dead that they didn't treat me better in life." In this way, death is a type of revenge against those he feels have mistreated him in life.

The present study is concerned with the development of attitudes toward death. Parents usually attempt to protect their children from the fact of death. Ilg and Ames (3) have chronicled children's reactions to death at various ages and several works offer guides for telling children about death but, on the whole, parents demonstrate their own inability to face death by telling children father has gone away on a long trip or trying to make them feel happy about daddy being in heaven. Their own actions usually reveal to the children that they, themselves, are not as happy as they claim to be. Death should be accepted as naturally as life. The matter-of-factness and lack of emotion over death felt by young children is altered by observing the reactions of others.

B. METHOD

Subjects were sixty Roman Catholic school children ranging in age from 5½ to 14 years. Subjects shall be designated as Groups A to G which correspond to their school year (primary to six) and ages shall be written as 5:5 signifying 5 years and 5 months. The children in each school year should have experienced the same academic and religious teaching, so that the development of their concepts should be at approximately the same level.

The interviews were purposely left relatively unstructured, as it was felt that a flexible interview situation was the more suitable due to the youth of the subjects and the danger of arousing anxiety concerning death. With the younger children, death was introduced only as one of a number of concepts to be defined (book, life, brother, etc.). Leading questions were also used: e.g., "Do you go to cowboy movies on Saturday afternoons or watch them on television? What do you think happens to the cowboys when they get shot?"

The informal, discussion type interview left the interviewer free to follow interesting leads, as each child's experiences with death would understandably differ. An attempt was made, however, to work the following questions into the discussion in some suitable form.

1. What happens when a person dies?
2. What does the corpse look like?
3. Does it hurt to die?
4. How do you know when someone is dead?
5. Can a dead person feel?
6. Do they stay in the coffin?
7. What do you understand of Heaven and Hell?
8. What does a dead person do in Heaven? In Hell?
9. Are you going to die someday? Why? When?
10. Is it all right to kill? Why or why not?
11. Can dead people come back to life?

When the older children were interviewed, two questions were added:

12. What are the causes of death?
13. Is it all right to kill in a war?

C. RESULTS

Group A ranged in age from 5:5 to 6:4. Several of the children in this group seemed rather puzzled and apprehensive about the questions, but, for the most part, they answered without undue concern.

Most of the children did not think it would hurt to die, although some said it

would without qualifying their answers as did the older children. All seemed certain dead people did not breathe, but several were a little doubtful whether or not people could feel when they were dead.

James K. (5:9)

"If you were dead, and I pushed you, could you feel it?"

"No."

"Why not?" (Pauses to think before answering)

"Yeah." (pause) "No." (pause) "I don't know."

Often the younger children contradicted themselves without seeming to realize it, indicating that their concepts were still relatively unstructured and flexible.

Gwen M. (5:5)

"What do you do in heaven?"

"Close your eyes and live with God."

"Could you play and move around when you are in heaven?"

"You could if you're not dead."

"Can you be alive and go to heaven?"

"No. You have to be dead to get there."

Patrick F. (6:2)

"Would you like to die?"

"No. I wouldn't like to go head first in a box and be buried."

...

"Will you die someday?"

"Yes. It'd be fun to die. If you don't have food you can die."

To children of this age, death is a remote entity. It is not generally perceived as something that could happen to them personally at present. *Mary S. (6:2)*, when asked when she thought she was going to die, replied, "Whenever I'm a woman." As was mentioned previously, relegating death to the future is a common attitude in most people, but children have an advantage in that they can easily put off death to old age as they are largely naive of the possibility of death occurring at any time.

Children of this age do not actually know what death is. They associate it with lying in a coffin with one's eyes closed, with being buried in the ground, and with not being able to move, sometimes, even in heaven. Death is seen in terms of the concrete rather than the abstract. It is too far removed to be feared.

Children in this group take death very matter-of-factly, without emotion. *Mary S. (6:2)* spoke with apparent pleasure about a baby brother who had died and was certain he was happy in heaven, though she was not anxious to go

there herself because she would not be able to play. *Colin R.* (7:4) also demonstrates this lack of emotion when asked what happened to his grandfather when he died. "I don't know. He died in the night. In 1963." Children are so used to new things and change that death has no peculiar connotations for them. A coffin in the living room would be accepted as easily as a new radio.

Several of the children in Group B (6:6 to 7:5) thought people died at the end of the world.

Lillian C. (7:1)

"Are you going to die?"

"Yes."

"When?"

"At the end of the world."

John M. (7:1)

"Are you going to die someday?"

"Yes, at the end of the world everybody will be dead."

"When do you think you will die?"

"I don't know."

Personal death still remains remote and far in the future. It is something that happens to others, but is not perceived as having immediate consequence for themselves.

When asked how they would get to heaven, they all replied that you had to "be good." No one mentioned the necessity of dying to get there. In their egocentricism, they assumed we know this fact, since further questioning indicated they all knew death to be a prerequisite for entrance to heaven.

Death was associated with lying down, not breathing, and having your eyes closed, but these answers had to be literally "dug out" of them through specific questioning.

Colin M. (7:4), when asked how he could tell when someone was dead, answered:

"The news or I hear people talking."

"How could you tell if I were dead?"

"'Cause you'd be lying on the ground and you wouldn't be breathing."

The majority felt you could not play in heaven, and this was usually one of the main reasons they were not too anxious to die.

Martha G. (6:7)

You can talk to the other angels but you can't play hopscotch because you're supposed to do what Jesus says and angels aren't supposed to play.

Thus, most picture heaven as a rather restrictive place where God replaces the parents in deciding what you can or cannot do. Although they state

heaven to be a "wonderful place," they do not particularly want to die because "It's fun to live."

When asked if it was possible to come back to earth from heaven, all felt you could not.

Michael C. (7:5)

No. Because you'd be up there and there's no ladder in heaven.

Lillian C. (7:1)

You couldn't get out. There's no door and God wouldn't let you.

It is interesting to examine the ideas of *John M. (7:1)*, whose father is an undertaker.

"What happens to cowboys who get shot in the movies?"

"They can't get alive."

"Why not?"

"'Cause they're dead and dead people can't come back to life."

"How do you know that?"

"'Cause my father's an undertaker."

"Have you seen very many dead people?"

"Sometimes."

"What does a dead person look like?"

"He looks like he's asleep but he's dead."

"What happens to you when you die?"

"You get buried."

"What happens to you after you get buried?"

"You go to purgatory, heaven, or hell."

"What's purgatory?"

"It's a place where your sins burn off."

"What's heaven?"

"You see God face to face."

"Do you think you would like that?"

"Yes."

"Why?"

"Because you adore God."

"Do you really think that would be nice?"

"I think it's beautiful."

In this age group, most of the children introduced heaven and hell themselves, but John was the only one to mention purgatory. He was also the only one in this group to make the distinction between body and soul.

"Do people stay in the coffin?"

"No, their soul goes to heaven. Their body stays."

It is probable that, since John's father is an undertaker, he would have greater occasion than would other children to wonder and ask questions about the dead.

Group C ranged in age from 7:5 to 8:4 years. When asked what happens to people when they die, the children generally answered that they go to heaven or hell, rather than just saying that they are buried. They no longer speak only of the concrete and visible aspects of death.

However, there still exists a tendency to contradict themselves, indicating that their abstract concepts are not yet well formed nor well handled.

James G. (7:7)

"Does it hurt dead people when you bury them?"

"No."

"Would it hurt them if you hit them with a baseball bat?"

"Don't know."

Janet L. (6:7)

"Does it hurt people to be buried?"

"No."

"Why not?"

"Because they're dead."

"Would it hurt if you were dead and someone hit you?"

"Yes."

Children in this group were becoming more spontaneous about the signs of death. There is no longer the need to extract information as with the younger children.

John M. (8:3)

"How do you know when someone is dead?"

"They're not breathing when they're dead."

"How can you tell?"

"The doctor can listen to their heart."

"How do you know all this?"

"I watch Dr. Kildare on TV."

This last statement (and others not quoted) illustrates the role of television in imparting information to children at a much earlier age than was normal 15 to 20 years ago. Most of these children still do not go to movies, but all watch television.

Russel M. (8:2)

"Do you go to the movies on Saturday?"

"No, my mother won't let me."

"Do you watch the cowboys on TV?"

"Yes."

"What happens to the cowboys when they get shot off their horses?"

"They fall down dead."

"Then what happens?"

"They turn into dust in a week or two or a couple of days. Some they bury in Dancers' Hill and places like that."

Not one child thought it was permissible to kill. A few in Group B and all in Group C stated that killing is a mortal sin and, therefore, it is wrong.

In contrast to Groups A and B, children in Group C recognized death as an immediate possibility.

Elizabeth P. (8)

"Are you going to die someday?"

"Yes."

"When?"

"Might die now, but I hope not. I'd rather live longer."

Group D, age 8:5 to 9:8 years, were beginning to make the distinction between body and soul, although they often were not entirely sure what happened to which.

James M. (9:3)

"What happens when a person dies?"

"They turn into dust when they get put in the coffin and are buried. Their souls never die."

"Can they come back to life?"

"No. They can when they go to heaven but they can't come back to earth. They get a new body in heaven."

Answers were becoming much more detailed. *Joseph M.* (8:11) gave a very descriptive account of death:

"What would they do with me if I died?"

"They'd put you in a coffin and have a Mass."

"Then what?"

"They have something like a parade. There's a big black car in front and they put you in it and they take you up to the graveyard."

"What happens after that?"

"They have something like a ceremony with Hail Marys and Our Fathers and everything. I'm not too sure about this, but I think they lower you on something."

"What happens to you then?"

"Your body just stays there and your soul goes. If you have a few sins, you go to purgatory, and if you're good you go to heaven, and if you're bad you go to hell."

Children at this age are beginning to recognize the fact they can die at any time, as was also realized by children in Group C.

Kevin G. (8:5)

"Are you going to die?"

"Yes."

"When?"

"When you get old, or before you get old, when you're sick."

James M. (9:3) answers similarly:

"Yes, everybody dies."

"When?"

"It's hard to say. I could die now. A heart attack could come over me."

There was also evidence of the beginning of a more objective and discriminatory view of pain in death.

Joseph M. (8:11)

"Does it hurt to die?"

"If you were shot it would. Maybe if you had a heart attack sometimes it would hurt. If you died in bed I don't think it would hurt that much."

James M. (9:3)

If you get shot like President Kennedy, it would hurt. It's painful in a disease when you're dying but it's not painful if you die in your sleep.

The authors found the children in Group E (9:6 to 10:11) more reticent about answering questions than were the previous groups. They were unwilling to venture a guess about what heaven was like and there were an increasing number of "I don't know's." One can theorize that their education has advanced sufficiently to decrease much of their naivety; they are more cautious about putting themselves "out on a limb." They also showed an unwillingness to say "hell," as though it were a "bad" word.

Most of the modes of death mentioned by this group were violent in nature.

Brian M. (10:1)

"What are some of the causes of death?"

"Jumping off a building. You could shoot yourself or hang yourself."

"What about the people who die every day?"

"They're in hospitals and that. They get sick or they get beat up."

Gerald S. (9:11)

"How can you die? What are some ways?"

"By a knife or a gun. You could fall off someplace, get sick or get hit with something."

Scott M. (10:3)

You could have a heart attack or die, or get shot—fighting in a war, get hit in the temple, be in a barn and fall on a pitchfork.

This type of death would tend to appeal to boys as many of their games involve violence and excitement. Girls, for the most part, gave causes that were a little less violent.

Doreen G. (10:2)

"How do people die?"

"They get sick. Some get heart attacks. Some get shot—but not too many."

Hildegard M. (9:6)

You could get shot, have a heart attack, die with pains, ulcers, or maybe appendix.

In response to the question, "How can you tell when a person is dead?" the common answer was, "dead people can't breathe (can't see their stomachs going up and down)." Some realize they can listen for a heartbeat or feel for a pulse, although none of the children in this study could find his own pulse.

The difference between the concepts of children in Group E and Group F is not significant. A person dies; he gets buried; his soul goes to heaven, hell, or purgatory; and the body decays. A dead person is distinguished by the fact that he is not breathing nor can his pulse be felt. Several felt a doctor's examination necessary to prove a person dead. There are many causes of death—car accidents, heart attacks, overdose of pills, drowning, cancer, etc. Heaven, to these children, is a rather solemn place. While believing they will be happy there, they do not think it will be much fun as they understand it.

Michael D. (10:8)

"What would you like to do in heaven?"

"Play hockey."

"Do you think you will be able to do that?"

"No. God probably won't let me."

Margaret M. (10:2)

"What do you think you'll do in heaven?"

"Adore God."

"Do you think you'll enjoy that?"

"I don't think it'll be much fun at all."

When asked what they will do in heaven, many are quite reluctant to surmise and will usually answer as did *George W.* (12:2) with, "I wasn't up there yet." Most do not understand what is going to make them happy in heaven although *Denyse D.* (11:5) answered, "You'd be with God. You were made to go with Him." They believe it hurts to die if you have a serious illness or if you have an accident, but not if you die in your sleep.

This age group is quick to point out that the cowboy or Indian on TV does not actually get shot.

Michael D. (10:8)

They leave them there and then when the camera is on another place, they get up.

Group G (10:10 to 14), on the whole, gave more mature answers to questions than did Groups E and F and were not afraid to ask questions themselves. A more direct approach to the topic was possible with this group.

The causes of death were not quite as violent as those given by the two previous groups. Probably Group G children are not as involved in "cowboy and Indian" type play and have had more contact with people dying of natural causes. They understand that they could die now if God wished, but death is still something that will probably not occur for a long time.

When asked, "What happens when you die?" several immediately made the distinction between spiritual and physical life and inquired which was meant. Asked to elaborate on both, they did so. Some brought up the fact that, although your body usually decays, God can by a special favor permit the body to remain intact for as long as He wishes. This, they noted, was one of the signs of sainthood.

Moir G. (10:10)

When they die their heart stops beating, they bury them and their body rots most of the time. In special cases like when people are canonized and God wants to show a special sign, He doesn't let them rot, like a priest who wouldn't tell a confession and God left his tongue but the rest of him rotted.

When asked what they will do in heaven, they answered that they would be happy with God, but very few mentioned the previously prevalent idea that the residents of heaven pray for the Church Suffering and the Church Militant.

Peter M. (12:3)

"What would you do in heaven?"

"Praise God. I haven't been there so I don't know for sure."

Michael W. (12:6)

"What would heaven be like?"

"You'd be happy. There'd be no suffering or pain. You see God so you are perfectly happy."

Stephen S. (11:5)

"What do you think of heaven?"

"I was never there to tell you the truth but when you get there you have eternal happiness with God."

"Could you play games there?"

"I don't have the faintest idea. You really wouldn't want to, I guess."

"What about hell?"

"It's a place where you suffer for the rest of your life and you never go to heaven."

Two boys, when asked about hell, explained there would not actually be any fire there although the condemned would suffer great pain.

David M. (11:9)

"What's hell like?"

"It's the place where people go who have mortal sins on their soul when they die. There's supposed to be fire there but there isn't . . . Fire is just a symbol and it symbolizes that you are going to suffer."

However, *Diane S.* (12:6) described hell thusly:

"You see all sorts of devils. There'd be lots of hollering."

"Why?"

"They're getting burnt and hollering for mercy from God."

Generally, their ideas of heaven and hell are vague because, as most of them said, "I don't know—I haven't been there." They are beginning to divorce the meanings of happiness and unhappiness in heaven and hell from merely worldly connotations.

Only two children, of all those interviewed, thought it permissible to kill. The general reason given was that it was a mortal sin and against the Fifth Commandment. However, the last two groups added that besides being a sin and costing the other person his life, it might also cost the murderer his.

Stephen S. (11:5)

"Is it all right to kill?"

"Nope."

"Why not?"

"'Cause if you do it's a mortal sin and you'll die for it if you ever get caught. You lose all grace and all that."

"Is it all right to kill in a war?"

"If you're fighting for your country. It wouldn't be on your conscience. You wouldn't want to do it, but you'd have to. If you went to war and you wouldn't kill anybody, they'd kill you."

D. COMPARISON WITH OTHER STUDIES

Maria Nagy (5) and *Schilder and Wechsler* (6) have reported on the concept of death in children. It is hoped that the present submission will arouse interest in the subject so that more detailed studies will be conducted.

The authors' findings support *Schilder and Wechsler's* statement that children deal with death and its paraphernalia in an utterly matter-of-fact and realistic way. Ideas were volunteered that were logical in a way surprising to adults. Such was the case of *Patrick F.* (6:2) who answered the question, "How can you tell when someone is dead?" with, "You hear it on the radio"; or *Peter C.* (6) who replied, "You see them in the coffin." Their matter-of-fact attitude is evident in the emotionless description of *John M.* (8:3) who informed us, "I had a brother who died when he was two days old at six o'clock in the morning. I was about two at the time because my grandfather died around that time too."

Unlike the children in previous studies, however, the children all believed in their own death, although it was something far off in the future to the younger ones.

The subjects emphasized the immobility of the dead—they cannot walk, see, eat, or feel, although there was some doubt about the feeling aspect. All believed in the finality of death rather than its reversibility as documented in other studies. None thought he could rise up from death at will and come back to earth. Interestingly, in the younger children, one or two felt you could come back to earth at the end of the world, while others felt they would not die until the end of the world.

Fear of death did not seem to be an actual force influencing children. Death seemed so far off that it need not be a matter of concern, though most felt they would not like to die.

Lillian C. (7:1)

"How would it feel to be dead?"

"Don't know."

"What do you think it would be like?"

"It'd be dark under the ground. I'd be scared to be there."

"Could you eat?"

"No, because there's no food."

"If they put food in the box, could you eat it?"

"No, because you're dead."

"Would you like to die?"

"No, it wouldn't be nice to be dead. You couldn't play."

Ronald G. (6:4)

"Would you like to die?"

"No. I wouldn't like to be dead."

"Why not?"

"Because you don't want to be dead and you won't be big very long and you won't have anything to eat and no one will play with you anymore."

The authors did not find the children to be "ready to kill," as did Schilder and Wechsler; or at least the subjects did not admit to it. All felt it was wrong to kill, either because it was against the law, or because their parents had told them it was wrong, or because they had learned it was a mortal sin against God's Commandments. However, this tendency to kill might come out only in play. Giving lip service to the wrongness of an act is not saying one will not engage in the act or at least the desire. "I'll kill you" is a common expression of anger in children, and many of their games involve "play killing."

Maria Nagy found that the child personifies death, especially between the ages of 5 and 9. The authors found no evidence of this depicting of death as a

dark, sinister figure who roams the earth in a sort of magician's role, removing people at will.

The idea is advanced that much of the difference may be a result of the religious training provided in school. Schilder and Wechsler's findings regarding religious morality and death were not supported in the present study. They encountered only one case out of 76 children between 5 and 15 in which religious morality affected the child's attitude toward death. Every child understood the concepts of heaven and hell and by age 7 was speaking of purgatory with an obviously clear understanding.

Thus, *Patrick F.* (6:2) said of death, "You can't see anyone anymore because you're buried. You go up to heaven where you're good and only see God and His angels." *Ronald G.* (6:4) answered, "Heaven is up there. It's God's place. He owns it and the world. The bad people can't go there. They go down to hell." *John M.* (7:1) thought he would "like to go to heaven even though angels can't play there." *Mary S.* (6:2) stated, "God lifts you up from under the ground but you can't see Him." Until about age 7, there is a difficulty in separating body and soul.

Patrick F. (6:2)

"What happens when you die?"

"You turn to sand."

"Does the dead person stay in the box?"

"No, he goes up to heaven."

"What goes up to heaven?"

"His whole body."

In addition, it is likely that television has played an important role in educating children on the complexities of death. Many mentioned Dr. Kildare and Ben Casey as a source of information. Those who had experienced a death in the family were especially verbal and notably matter-of-fact about the subject. Having an animal that died also increased their knowledge. They were able to distinguish between the death of animals and humans.

As the sample was small in number, it is hoped that further studies will provide more precise information on the formation of this concept, since it is important that people gain a healthy understanding of death. It is as unhealthy to pretend one will live forever as it is to be morbidly preoccupied with death.

E. SUMMARY

Sixty children were interviewed to determine their reactions and theories on death. This concept solidifies and largely standardizes with age. Children can

accept death matter-of-factly, but acquire a fear of death by observing the behavior of adults.

Some of the attitudes reported in other studies (notably reversibility and personification of death) were not observed in the present subjects. It is thought that early religious teaching and television may acquaint the child with the facts of death earlier than was usual in times past.

The development of this concept is deemed worthy of comprehensive study so that parents can be aided in informing their children about death. It would appear that frank, simple explanations are more advisable than trying to conceal death from children.

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A CASE STUDY IN DISCRIMINATION LEARNING*

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A. INTRODUCTION

This case study provides a conditioning paradigm illustrating the solution to a specific problem in child rearing. The problem arose in the following manner. When the subject was approximately 20 months of age he would begin to call "Mommy" or "Daddy" on awakening. This call was to inform the *Es* he was ready to get up and to begin his day's activities. He, naturally, would awaken at different times and his calling would continue until he was allowed to get up. On the days when he would awaken early this was disturbing to the *Es*. On some occasions one of the *Es* would enter the room and tell the child it was not time to get up. Sometimes the child would go back to sleep, but on some days he would wait for 10 to 15 minutes and begin to call again. The *Es* decided that what was desired was to have the child call when he was ready to get up and, thus, be allowed sufficient sleep, but that he should not call until eight o'clock. The problem, thus analyzed, lent itself to a discrimination learning situation.

B. METHOD

1. Subject

The subject was a healthy normal male child who was 21 months old at the start of the study.

2. Procedures

The response used was the number of times "Mommy" or "Daddy" was called. On Day 1, 2, and 3 when the *S* arose before eight o'clock he was allowed to call until eight o'clock at which time one of the *Es* went into his room and picked him up. On each day the number of calls that he made was tallied. On Day 4, the same procedure was followed except that at eight o'clock a small lamp was lit in the *S*'s room. This lamp consisted of a small white night light (7½-watt bulb), similar to Christmas tree lights. The light was situated approximately five feet from the crib and at the *S*'s eye level and in

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his line of vision when he would stand up and call. On Day 4, at eight o'clock, the light was turned on by the *E* plugging in an extension cord outside of the room. As soon as the *S* called "Mommy" or "Daddy" after the light was on, the *E* entered the room to get him up. The *E* then said, "It's time to get up. When the light comes on it's okay to get up." On subsequent days the light would be turned on at eight o'clock and as soon as the *S* said "Mommy" or

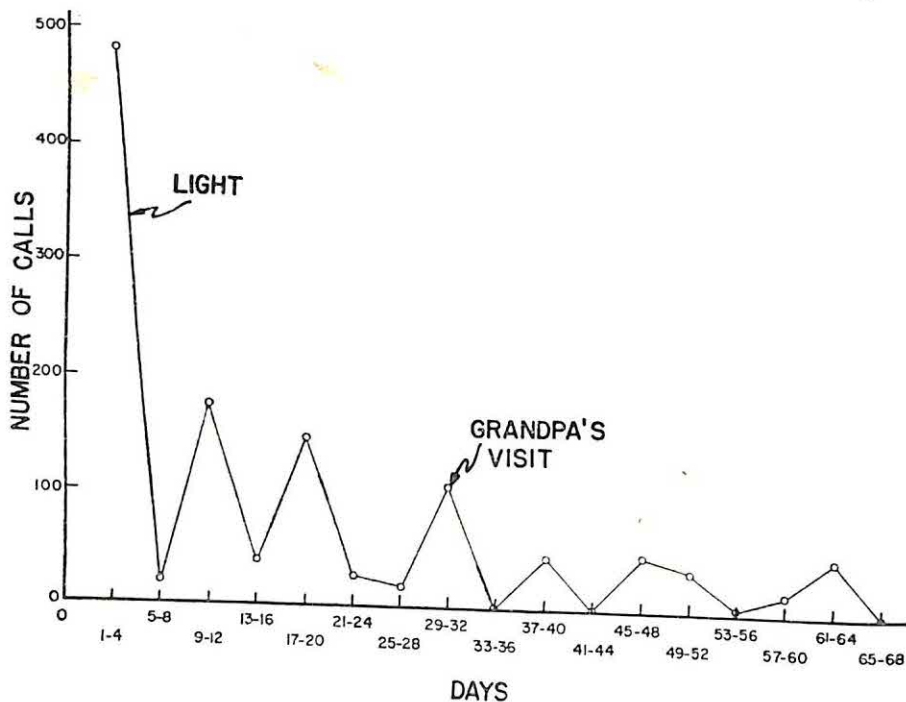


FIGURE 1
NUMBER OF CALLS OF "MOMMY" OR "DADDY" PER FOUR-DAY BLOCKS

"Daddy" after the light came on one of the *E*'s would enter the room and get him up. Thus the calling of "Mommy" or "Daddy" was rewarded only when the light was on. On each day the number of calls of "Mommy" or "Daddy" prior to eight o'clock was tallied.

C. RESULTS

The results are presented in Figure 1. The number of calls per four-day blocks are plotted. Note that the curve drops following the introduction of the light, which indicates the *S* was learning to make the discrimination. On days

29 to 32 there were 101 responses made. In that four-day block there were three days of zero responses and one day of 101 responses. That one day was preceded by a visit of the child's grandfather. The *S*'s grandfather was not aware of or had forgotten about the experiment, so when the child called the grandfather entered the room before the light could be turned on. The following day the child emitted 101 responses.

D. DISCUSSION

The collection of data terminated at the end of 68 days even though the curve was not asymptotic to zero. There are three possible reasons for the training not to be complete. One is that the number of calls is related to how long the subject sleeps. Thus if he sleeps past eight o'clock he would not call. Certainly the physiological condition of the *S* (hungry, wet, tired) would then have an effect on number of responses. The second reason is that there were stimuli other than the light to which the *S* may have been responding: e.g., the sunshine coming into the room. Lastly the response of the subject (calling "Mommy" or "Daddy") was rewarded during the day when the light was not lit.

Note that the learning did take place without the use of any aversive stimuli. The light has continued to be used by the *Es* and the *S* has trained a younger sister to obey it. The *S* is now 6 and there appear to be no adverse side effects nor long term effects as far as his behavior is concerned.

E. SUMMARY

The problem involved in this study arose when the *E*'s 21-month-old son would awaken early and call "Mommy" or "Daddy." The *Es* wanted *S* to call when ready to get up, but not before 8 A.M. The number of calls prior to 8 A.M. was recorded for four days. At 8 A.M. on the fourth day the *Es* lit a light in the *S*'s room. When the *S* called after 8 A.M. he was reinforced by one of the *Es* entering his room and taking him from his crib. Results show that the *S* learned the discrimination.

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VALIDITY OF THE VARIABLES ON THE STRUCTURED-
OBJECTIVE RORSCHACH TEST (SORT) AMONG
ALCOHOLICS, NEUROTICS, AND PSYCHOTICS*¹

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A. INTRODUCTION

Although designed to measure temperament patterns in vocational counseling, recent research (7, 8, 9) with the Structured-Objective Rorschach Test, SORT (6) indicates its construct validity as a clinical instrument.

In the present study, the author investigates the ability of Rorschach rationale, as used in the SORT variables, to differentiate among alcoholics, neurotics, and psychotics. This investigation tests the hypothesis that there are no significant differences on the SORT variables among alcoholics, neurotics, and psychotics.

B. METHOD

The data for the alcoholic, neurotic, and psychotic groups of 50 patients each were obtained from veterans. They were admitted to the short-term neuropsychiatric treatment service at Brown General Hospital, Veterans Administration Center, Dayton, Ohio in the winter of 1964 and spring of 1965, and diagnosed by a psychiatrist. Table 1 reveals their mean chronological age and mean education grade.

The procedure was to administer the SORT (illustrated edition) to the first 50 literate patients admitted in each of the three categories. Comparisons of these means and standard deviations with those in SORT norms have been published (7, 9). Since the original SORT paper on 25 neurotics (8), 25 more neurotics were accumulated for this study.

C. RESULTS

Table 1 presents the results of an analysis of variance on the data for 15 SORT variables among alcoholic, neurotic, and psychotic groups. Six significant SORT variables were partialled out: namely, minor details, form re-

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TABLE 1
MEAN, *SD*, AND *F*-TEST FOR 15 SORT VARIABLES AMONG NEUROTICS, PSYCHOTICS, AND ALCOHOLICS

SORT variable	SORT raw scores					
	Alcoholics (<i>N</i> = 50)		Neurotics (<i>N</i> = 50)		Psychotics (<i>N</i> = 50)	
	Mean	<i>SD</i>	Mean	<i>SD</i>	Mean	<i>SD</i>
Whole blot	31.58	5.22	31.52	6.48	30.42	6.09
Major details	54.26	4.35	53.24	5.21	52.12	6.48
Minor details	13.50	3.27	14.72	3.92	16.90	5.08
White space	11.26	2.93	11.78	2.67	12.38	3.30
Form resemblance	25.68	4.34	26.48	5.67	28.10	5.74
Poor form resemblance	13.80	3.01	13.38	2.78	13.80	3.29
Human movement	7.08	3.31	6.70	3.38	7.50	4.00
Animal movement	10.92	2.79	10.30	2.35	10.96	2.72
Color and form resemblance	12.88	2.52	12.98	2.38	11.44	2.79
Color and poor form resemblance	8.50	2.89	8.60	2.47	8.72	2.20
Shading	20.42	3.62	21.04	3.67	18.82	3.54
Animal figure	34.10	4.81	33.74	4.89	33.82	6.24
Human figure	21.68	4.29	20.00	5.88	22.30	6.06
Modal response	52.44	6.23	52.60	7.35	48.08	7.20
Rare response	6.90	3.38	7.00	3.39	9.66	4.72
Age	47.88	8.86	44.46	9.71	38.02	7.51
Grade	10.88	3.17	9.78	2.56	10.54	2.75

* $p < .10$.** $p < .01$.

semblance, color and form resemblance, shading, modal responses, and rare responses.

Table 2 uses the New Multiple Range Test by Duncan (1) to show the level of significance for the ordered means of these six SORT variables in a multiple comparison of alcoholic, neurotic, and psychotic groups.

The striking finding in Table 2 is the lack of a significant difference for any of the six SORT variables when alcoholics and neurotics are compared. When alcoholics and neurotics are compared separately with psychotics, all six SORT variables are significantly in favor of Rorschach rationale. In both

TABLE 2
SIGNIFICANCE OF THE DIFFERENCES FOR ORDERED MEANS IN SIX SORT VARIABLES
BY THE DUNCAN NEW MULTIPLE RANGE TEST

SORT variable	Alcoholic vs. neurotic	Alcoholic vs. psychotic	Neurotic vs. psychotic
Minor details	1.22	3.40***	2.18*
Form resemblance	0.90	2.42*	1.62
Color and form resemblance	0.10	1.44**	1.54**
Shading	0.62	1.60*	2.22**
Modal response	0.16	4.36**	4.52**
Rare response	0.10	2.76***	2.66***

* $p < .05$.

** $p < .01$.

*** $p < .001$.

groups, five of the six significant SORT variables are identical; only the SORT variable for form resemblance shows a significant difference ($p < .05$) between alcoholics and psychotics, but not between neurotics and psychotics.

The shading variable, a measure of anxiety, was confirmed in favor of Rorschach rationale by this SORT study between alcoholics and psychotics at the .05 level and between neurotics and psychotics at the .01 level. Therefore, the finding by Langer *et al.* (2, 3, 4) that the human-figure response rather than the shading response may be the measure of anxiety for college students on the SORT would not apply in determining the validity of the SORT shading variable in a multiple comparison of alcoholic, neurotic, and psychotic veterans.

The validity of the SORT modal variable becomes more impressive when compared with a traditional Rorschach study (5) where no significant difference was found in the number of modal responses between neurotic and psychotic patients, but in the same relationship this study found a significant difference at the .01 level.

D. SUMMARY

The SORT was administered individually to the first 50 literate patients admitted in each of the categories—alcoholic, neurotic, and psychotic. The findings were compared with the following results: (a) Between alcoholics and neurotics, there was no significant difference in Rorschach rationale as used with any one of the 15 SORT variables. (b) When alcoholics and neurotics were compared separately with psychotics, six of the 15 SORT variables revealed significant differences for Rorschach rationale. In both categories, five of the six significant SORT variables were identical at the .05 to .001 level of significance: namely, minor details, color and form resemblance, shading, modal responses, and rare responses. The SORT variable for form resemblance was significant at the .05 level between alcoholics and psychotics, but not between neurotics and psychotics. (3) The shading variable was found significant at the .05 and .01 levels for both alcoholics and neurotics, respectively, when compared with psychotics. This clinical finding for the shading variable counters recent SORT studies of college students which have determined that the human-figure variable rather than the shading variable is the measure of anxiety.

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CHILDREN'S COGNITIVE STYLE AND RESPONSE MODIFICATION*¹

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A. INTRODUCTION

The dynamics of behavior may be conceptualized as involving competing tendencies of response generalization *versus* response differentiation. Response generalization refers to the assignment of the same response to slight variations in the physical stimulus, thus inducing behavioral stability; whereas response differentiation involves giving different responses to different stimuli, thus inducing behavioral change. Too little response generalization, or excessive response differentiation, could result in labile, unstable behaviors. Conversely, excessive response generalization or insufficient differentiation between responses given to different stimuli would result in unchanging behavior that might be termed "rigid" or "unflexible." Middle ranges of response generalization and differentiation would seem desirable for optimally adaptive behavior.

The present study is concerned with the role of prior learning, manifested as a testable ability (7, 8) in response modification. High levels of ability, or prior learning, are presumed to produce correspondingly greater tendencies toward response generalization in a free, unstructured situation: i.e., a situation that does not explicitly demand, require, or suggest response differentiation.

The abilities employed in this study involve behavioral automatization: i.e., behaviors that have been so highly practiced that little conscious effort or attention is required for their efficient execution. Such behaviors include the bulk of everyday activities: e.g., keeping one's balance, walking, talking, reading, maintaining perceptual constancies, writing, etc. A cognitive style

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approach to automatization assesses the strength of automatized responses relative to the individual's general level of ability, rather than against performances of other individuals (2, 3, 4). Thus, the automatization cognitive style is defined as greater ability (Strong Automatization) or lesser ability (Weak Automatization) to perform simple repetitive tasks than expected from the individual's general level of ability.

The expectation of the present study is that Strong Automatizers (individuals with relatively better learned, strong responses to simple common stimuli: e.g., objects, colors, etc.) will have greater response generalization to a series of gradually changing pictures of common, everyday objects (a cat and a dog) than will Weak Automatizers: i.e., Strong Automatizers will tend to give the same response to a wider range of varying stimuli than will Weak Automatizers.

B. METHOD

1. *Subjects*

All of the boys (40) in two fourth-grade classes of a local lower middle-class elementary school were employed as Ss. The average age of the Ss was 9.84 years with a sigma of .50 years. The average *IQ*, as measured by a school administration of the Otis Alpha Test of Mental Abilities, was 104.8, with a sigma of 9.6 *IQ* points.

2. *Cognitive Tests*

The present research conceives of cognitive styles as patterns of intraindividual variation in abilities. Such intraindividual variations may be expressed in the form of ipsative scores: i.e., deviations of the individual's score on each task from his mean level of performance on a battery of heterogeneous tasks. Ipsative scores on automatized tasks have been found reliably opposed to ipsative measures of "restructuring" tasks: i.e., tasks that require that initial, automatized responses to obvious stimulus attributes be set aside in favor of a response to new, less obvious, stimulus relations (4). Examples of such "restructuring" tasks are the Thurstone-Gottschaldt Figures, the WAIS Blocks Design Subtest, Porteus Mazes, etc. Ipsatization of a small battery containing equal numbers of automatized and restructuring tasks produces approximately the same discrimination between Ss as automatization factor scores derived from much larger and heterogeneous batteries of tasks (5). Hence, the present battery employed six tests: three automatization and three restructuring.

Since automatization and restructuring tasks are thought to reflect opposite

abilities, the experimental predictions for the restructuring tasks are also the opposite of those for the automatization tasks. For instance, whereas good performances on the automatization tasks should be positively related to response generalization, good performances on the restructuring tasks should be negatively related to response generalization.

3. *The Automatization Tasks*

a. Speed of naming repeated objects. This task requires the *S* to name, as fast as possible, 70 pictures of a cup, a tree, and a fly, 10 pictures to the line, in random order. The time taken to complete the task was taken as the score for the test.

b. Speed of naming repeated color hues. This task requires *S* to name, as fast as possible, 70 red, green, and blue color blocks randomly arranged 10 to a line. The time required to complete the task was taken as the score for the task.

c. Speed of reading repeated color names. This task requires *S* to read, as fast as possible, seven lines of the words "red" and "green" and "blue," 10 words to the line, in random order. The time taken to complete the task was taken as the score for the test.

4. *Restructuring Tasks*

a. WAIS Blocks Design Subtest. The second, third, fourth, fifth, and sixth designs of the WAIS Blocks Design Subtest (17) were administered to each *S*. The first design was used as a demonstration. The score for this task was the sum of the times taken to complete each of the task designs. The maximum score for the first two designs was limited to 75 seconds, and 150 seconds for the last three designs.

b. Thurstone-Gotteschaldt Figures. Seven problems from the Thurstone-Gotteschaldt Figures (16) were selected for administration. Each problem required four judgements. The total number of correct judgements minus the number of errors was taken as the score for this task.

c. Porteus Mazes. Five forms of the Porteus Mazes, Vineland Revision, Years V, VI, VII, VIII, and X (14), were administered to each *S*. The total number of wrong alleys entered in all five mazes was taken as the score for the task.

5. *Test of Response Generalization*

The Child Transition Test (1) was used as the test of response generalization. This test, which stems from research on the concept of tolerance-

intolerance of ambiguity, is a five-card, reversible series containing first a line drawing of a cat, three cards of transitional figures, and a picture of a dog on the fifth card. In addition to the reversibility from cat to dog, or dog to cat, there are two color sets; one with black figures on a white background; the other with these colors reversed. Each subject was shown one series, one card at a time, and asked, "What is this?" The verbatim response was recorded. Each child was retested, with reverse order and color, a minimum of 14 days later. Rank orderings were made in terms of point of shift and number of shifts within each set of five cards by two independent judges not otherwise connected with the study.² The rank order correlation of the judgements was .92. Individuals who shift early and often are presumed to have lower response generalization, while individuals who shift late and seldom are considered to have higher response generalization.

C. RESULTS

The various distributions of cognitive performance scores were standardized and normalized via transformation to McCall *T* scores (10). Those cognitive tests in which a small score indicates a good performance (the three Automatization Tasks, the Porteus Mazes, and the WAIS Blocks) were then reflected about the means of their respective *T*-score distributions such that the previously smallest score became the largest score and *vice versa*. Large scores on all tests then connoted superior performances, and the various performance scores were then additive. Hence, each *S*'s *T* scores on the six cognitive tests were summed and divided by six to provide the *S*'s mean level of performance on the battery. Ipsative scores, reflecting variations in abilities within an individual, were then computed for each *S* by subtracting that *S*'s mean *T* score for the battery from each of his six test *T* scores. The resulting differences, or ipsative scores, indicate whether an individual's ability on a given test is greater than or less than his mean level of ability for the total battery.

Finally, an index of cognitive style was derived from the six tasks by subtracting the sum of the ipsative scores of the three restructuring tasks from the sum of the ipsative scores of the three automatization tasks. The resulting difference, the index of cognitive style, reflects the extent and direction of an individual's variation in ability on automatization *versus* restructuring tasks.

Intercorrelations of the various cognitive scores and the Child Transition

² The authors give their sincere thanks to Bess Gene Holt and Jeanne M. Blum who served as judges for the rankings.

Test were then performed. In all cases, a positive correlation reflects an association between superior task performances and greater response generalization, while negative correlations indicate superior task performances associated with lesser response generalization.

Table 1 presents the correlations of the six sets of ipsative cognitive scores, the mean *T* score for the six cognitive tests, and the index of the Automatization Cognitive Style, with the Child Transition Test (CTT).

TABLE 1
CORRELATIONS^a BETWEEN COGNITIVE INDICES AND THE CHILD TRANSITION TEST
FOR FOURTH-GRADE BOYS
(*N* = 40)

Cognitive tests	Child Transition Test
Automatization tasks: (Ipsative scores)	
Naming objects	.393*
Naming color hues	.317*
Reading color names	.190
Restructuring tasks: (Ipsative scores)	
WAIS Block Designs	-.180
Thurstone-Gotteschaldt	-.223
Porteus Mazes	-.316*
Index of automatization cognitive style	.387*
Mean performance level on all six tasks	.040

* $p < .05$.

^a Positive correlations imply positive associations between superior task performances and response generalization.

All of the automatization tasks are positively correlated with the CTT, while all of the restructuring tasks are negatively correlated with the CTT.

Two of the three automatization cognitive tasks (naming objects, and naming color hues) are significantly correlated positively with the CTT indicating that individuals with relatively strong responses to these simple stimuli tend to persist in their original response to the CTT: i.e., they show high response generalization. One of the restructuring tasks (the Porteus Mazes) is significantly correlated in a negative direction with the CTT, indicating that individuals who are relatively proficient on the maze task tend frequently to change their responses to the CTT stimuli.

The correlation of the mean performance level of all six tasks is approximately zero, indicating that between-individual normative differences in general ability to perform this battery of tasks is not related to the performance of the CTT. On the other hand, the index of the automatization cognitive

style, which reflects the extent and direction of the within-individual variance on the automatization *versus* restructuring tasks, is significantly and positively correlated with the CTT. This latter correlation indicates that the intra-individual patterns of abilities, in which the ability to automatize is better developed than restructuring abilities, are associated with a tendency to persevere in the response to the CTT.

D. DISCUSSION

The findings of this study substantively support the hypothesis: Strong Automating individuals (in this case, 10-year-old boys) have greater response generalization to common familiar stimuli than do Weak Automaters.

As we have seen, the individual who can perform simple, repetitive tasks better than expected from the level of his general cognitive performance is also the individual who is less likely to alter his responses in the presence of transitional changes than is the individual with the reverse pattern of cognitive relationships.

Interpretation of the functional significance of the results poses an interesting problem. Giving the same response to changing stimuli is often interpreted as evidence of rigidity or the inability to change. Response persistence on the CTT has, in fact, usually been interpreted as rigid behavior (1). In turn, rigid behavior is generally considered to be reflective of a lower level of cognitive development (18), and to be less adaptive (15) than flexible behavior. Strong Automatizers, who tend to persist with their previous responses across stimuli changes on the CTT, would therefore be considered to be rigid, relatively unadaptive individuals compared to Weak Automatizers. The relative difficulty encountered by Strong Automatizers in performing restructuring tasks (4) also supports this notion. The successful solution of restructuring tasks, according to Witkin (19), requires an analytic cognitive style which should, presumably, enhance cognitive flexibility.

Another source of support for the notion that Strong Automatizers are relatively rigid individuals comes from the literature on early and late physical maturation. Dr. Mary Cover Jones, in a report on her investigations of early and late maturers (12, p. 7), states, "We have found no significant differences in tested mental ability for the late as contrasted with the early maturers. The implication here is that difference in rate of maturing may be related to different modes of expressing intellectual competencies. This is further suggested in the late maturers' higher scores on psychological mindedness and *flexibility*."

The findings seem to corroborate those of Dr. Jones. We have previously observed that male Weak Automatizers seem to be physically late maturing individuals, whereas Strong Automatizers appear to be early maturing individuals (6). Thus, Weak Automatizers, who seem to be relatively late maturers, were found to modify their behavior more readily than did the early maturing Strong Automatizers.

An impressive amount of evidence, then, supports the notion that Strong Automatizers, who demonstrate greater response generalization on a specific type of task than do Weak Automatizers, are also more behaviorally rigid and less flexible than are Weak Automatizers.

Equally impressive evidence, however, can be mustered for the opposite possibility: namely, that the greater response generalization evidenced by Strong Automatizers represents stable behavior with adaptive value. For instance, it can be argued that the maintenance of the original response in the face of transitional changes on the CTT is evidence of cognitive flexibility, since the individual is then including new and diverse stimulus relations within his original concept.

Strong Automatizers are also better able to inhibit responses to nonrelevant stimuli, as on the Stroop Word-Color Interference Test, than are Weak Automatizers (2, 13). With this and similar phenomena in mind, Klein (13) suggested that individuals who are able to disregard the nonrelevant stimuli on the Stroop Word-Color Interference Test had "Flexible Cognitive Controls," while individuals who were unable to avoid response to the nonrelevant stimuli on the Stroop Word-Color Interference task were said by Klein to have "Constricted Cognitive Controls." In a consistent manner, Strong Automatizers have been found to be less distractible than Weak Automatizers (2). Strong Automatizers have also been found to be better able to reverse the significance of overlearned cues than are Weak Automatizers (5).

Theoretically, behavioral automatization is thought to reduce the amount of attentional energy required for performance of highly practiced behaviors with a corresponding increase in the amount of attentional energy available for the acquisition of new behaviors (9). This economic aspect of automatization should produce a more effective adaptive individual. Studies of adult Strong and Weak Automatizers (4) and Jones' follow-up studies of early and late maturers in adulthood (11) are consistent with this notion. These studies indicate that Strong Automatizers, or early maturers, are more successful in their occupations than are Weak Automatizers, or late maturers.

Hence, there appears to be an abundance of evidence supporting the alternative possibility that Strong Automatization and strong response

generalization on the cat-dog task are associated with flexible, adaptive behaviors.

One possible resolution of this conflict is that both interpretations are right, but for specific and different types of behaviors. For instance, Strong Automatizers may be better able to flexibly modify their behaviors than Weak Automatizers when the behavioral goal is clear and unambiguous, as in over-learning situations (5) or distraction experiments (2); but less likely to modify their behaviors in the absence of a clear directive set, as in the CTT, or where the desired response is hidden or uncertain, as in restructuring tasks. Additional discussion of this possibility has been presented elsewhere (4). In any event, more precise analyses of the behavioral and psychological differences of situations in which automatization is associated with rigidity, or lack of behavioral change, *versus* flexible modifications of behavior may greatly enhance our understanding of the factors governing behavioral dynamics.

E. SUMMARY

The present study is concerned with the relationship of prior learning, assessed as a present ability, to response modification. The Automatization Cognitive Style is defined as a greater (Strong Automatization) or lesser (Weak Automatization) ability to respond to previously learned, simple, repetitive stimuli than might be expected from the individual's general level of ability. Data obtained from fourth-grade boys support the hypothesis that the Strong Automater will have greater response generalization to a series of gradually changing pictures of familiar objects (a cat and a dog) than will Weak Automatizers. The results are discussed in terms of their possible significance for adaptive functioning.

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A FACTORIAL STUDY OF THE EGO REFERENCE SYSTEM*¹

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A. INTRODUCTION

Freud's term "super-ego" has become almost as well-known as the word "conscience" to which he related it, but its precise significance has always been a little unclear. In his earlier discussions Freud (13) himself spoke of the "ego-ideal," but at that stage he seems to have envisaged conscience as a complementary concept, the agent which relates to the ego-ideal. The concept of the "super-ego" involved the dual functions of conscience and ego-ideal, but at the same time Freud seems to have increased the emphasis on the negative aspects of the ideal which has become "the representative for us of every moral restriction" (14, p. 67). The earlier concept of the ego-ideal had more in common with McDougall's (17) "sentiment of self-regard," which also stressed the positive aspects of ego-striving. The details of psychoanalytic doctrine are not of concern here, but it is interesting to note that Freud himself realized that his super-ego had at least dual aspects.

The first explicit discussion of the ego reference system is probably to be found in William James (16). His notion of a hierarchy of selves is, in some respects, more in accord with recent thinking than is Freud's own contribution, but James was unable to give any hint of the unique development of the super-ego moral reference frame. What is involved is not just identification, or simple aversive conditioning, but the effect of a threat to the basic security of the organism: i.e., the loss of parental love. Both Freud and McDougall stressed the special role of the parents in the development of the super-ego system.

Factorial studies have confirmed clinical concepts in this area. Cattell (2, 4) found two factors that appear to correspond with ego-control (Q3) and super-ego formation (G), respectively. These were sufficiently well confirmed to be included in the Sixteen Personality Factor (16 PF) test of Cattell and Stice (10). Other studies have isolated a "self-sentiment," a "super-ego

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sentiment," and a "self-assertive" erg [see Cattell (3), Cattell and Cross (6), Cattell and Miller (9), Cattell and Baggailey (5), and Cattell and Horn (7)]. Cattell and Horn (8) found confirmation of these three factors, but the super-ego factor appeared in at least three forms: a factor highly loaded with 16 PF G score, "commentive" super-ego characterized by a strong tendency to agree, and "attitudinal super-ego" with religion as a major component.

The Cattell and Horn paper (8) emphasizes the need to look a little more closely into the question of super-ego organization. It seems generally to have been assumed that Freud's super-ego, or at least his ego-ideal, corresponds to McDougall's sentiment of self-regard and that both of these relate to the function of "conscience." Cattell and his co-workers raise the question as to whether we have just one entity and whether the notion of introjection of the parental code does not mask more subtle factors. Unfortunately the Cattell and Horn study leaves some room for doubt as to the precise interpretation of the factors involved. With commendable zeal they included many objective-type tests in their analysis, but these do not lend themselves to fine distinctions in interpretation. It was decided, therefore, to carry out a further analysis using individual questionnaire items which might give better clues as to the nature of the factors found.

B. HYPOTHESIZED FACTORS AND QUESTIONNAIRE

The Cattell and Horn research was studied carefully in conjunction with previous research and in the light of clinical concepts. Apart from Freud's own writings, Flugel's *Man, Morals and Society* (12) was especially useful with regard to psychoanalytic ideas. The original naming of the Cattell and Horn factors was regarded as suggestive only and alternatives considered. In particular the "Narcistic Self Sentiment" was regarded as being more meaningful in its other-regarding aspect and to be better considered as centering around loyalty.

Three other major aspects of behavior that were carefully considered are those of emotionality, ego-control (particularly in regard to choice behavior), and integration. It seems highly probable that any undue degree of emotionality will lead to instability of behavior (impulsivity as opposed to making a decision in accord with the reference system) because the immediate drives are too powerfully activated by emotional feedback. Eysenck (11) has found differences in emotionality as the major basis of neurotic behavior. Cattell has two factors in his 16 PF series that are concerned with an ego-control function: Q3 and C. Q3 is clearly a control factor, but Factor C seems to

waver between the effects of positive control and the interference produced by high emotional involvement. There appears to be a similar confusion of positive and negative aspects of control in the MMPI "ego-strength" factor [see Adcock (1)].

So far as integration is concerned, it is obvious that any lack will result in conflict and difficulty in making moral decisions. It is very difficult to write satisfactory questionnaire items in this connection and a paired-comparison technique was developed as the chief means of measuring this factor. Unfortunately it was not possible to include this measure in the present analysis as it was impossible to administer this test to the original subjects, although further study is currently being undertaken.

The factors set out below were finally hypothesized for investigation and suitable questionnaire items written around them. It was particularly hoped that these would give a measure of all the major aspects of choice behavior: the inhibition of impulsive response, the emotional reactivity operating against this, and the chief affective reference systems appropriate to be invoked in the process of deciding. The numbers of the relevant questions appear here after the name of the hypothesized factor, and abbreviated descriptions of the questions are provided in the following section on the factors and their interpretation. The hypothesized factors were: I. Superego (1, 8, 15, 22, 27, 32); II. Ego-ideal (2, 9, 16, 23, 28, 33); III. Self-sentiment (3, 10, 17, 24, 29, 34, 37); IV. Loyalty (7, 14, 18, 21, 36); V. Integration (5, 12, 19); VI. Ego-control (6, 13, 20, 26, 31); VII. Emotionality (4, 11, 25, 30, 35, 38, 39). The questionnaire itself has been deposited with the American Documentary Institute.²

C. ADMINISTRATION AND ANALYSIS

The test was administered to 269 students (164 male and 105 female) in an introductory psychology class at the University of Illinois as part of their course. Product-moment intercorrelations were calculated on the IBM 7095 computer and submitted to a principal-factor analysis. After a first run with unity in the diagonals, the number of factors was decided from a consideration of the latent roots. Ten factors were found to have latent roots not less than 1.1. Since this was more than originally postulated, and since Guttman (15)

² A copy of the Questionnaire-E. S. and of the Varimax Rotated Factor Matrix has been deposited as Document number 9144 with the ADI Auxiliary Publications Project, Photoduplication Service, Library of Congress, Washington 25, D.C. A copy may be secured by citing the Document number and by remitting \$1.25 for photoprints, or \$1.25 for 35-mm microfilm. Advance payment is required. Make checks or money orders payable to Chief, Photoduplication Service, Library of Congress.

has shown that factors with latent roots less than unity are not significant, it was decided to fix the number of required factors at 10 and iterate to stabilize communalities. After 25 iterations the root mean square of the residuals was .03114.

The 10 factors were then submitted to varimax rotation because at this time a program for oblique rotation was not available for this computer. This, unfortunately, precluded a second-order analysis or even simple consideration of correlation between factors, but did not interfere with the testing of the hypotheses in which the authors were interested.

D. THE FACTORS AND THEIR INTERPRETATION

The full matrix of factor loadings has also been lodged with the American Documentary Institute. Here the authors discuss the factors in order of their contribution to the variance. No loadings below .20 are considered.

Items hypothesized for each factor are indicated by an asterisk.

Factor 1: Ego Control (Variance 2.267).

- * .66 Q20 *S* often acts without sufficient thought for consequences.
- * .61 Q 6 *S* does things for which he feels sorry afterwards.
- * .57 Q13 *S* fails to maintain careful control over behavior and consequently experiences shame resulting from failure to live up to ideals.
- .47 Q28 *S* occasionally experiences shame because he has failed to live up to ideals in some way.
- .42 Q12 *S*'s attitude changes after he has decided upon some course of action.
- .29 Q 2 *S* does not consider one should be overconcerned about the respect of others.
- .28 Q 5 *S* has difficulty in deciding what he ought to do.
- .26 Q11 *S* becomes panicky with little provocation.
- .25 Q35 *S* wishes his emotions were not so intense.
- .22 Q25 *S* feels embarrassed in social situations.
- .21 Q24 *S* does not seek top marks.

The first three items belong to the hypothesized control factor and would seem to identify this factor. Q28 is very similar to Q13 although it was designed to measure ego-ideal, which it completely fails to do. Q12 was included for the integration factor, which has failed to appear, probably because of lack of adequate items. Q11 and Q35 are emotional measures and

get much higher loadings (.38 and .46) on the emotionality factor than on the present factor. There is obviously some contamination here, but the really important point is that the two factors have been definitely separated. As will be seen below, the emotionality factor emerges as a distinct well-defined factor.

Factor 2: Emotionality (Variance 1.851).

- * .58 Q30 S is inclined to worry.
- * .54 Q 4 S easily loses his temper.
- * .46 Q35 S wishes that his emotions were not so intense.
- * .39 Q39 S swings from being very happy to being very sad.
- * .38 Q11 S becomes panicky with little provocation.
- * .36 Q38 S feels an intense thrill of delight in contemplating some scenes.
- .35 Q26 S's conscience continually nags even when he can find justification for an action he considers to be wrong.
- .28 Q31 S thinks he is perhaps too "straightlaced."
- .22 Q18 A sad story brings tears to S's eyes.
- .22 Q34 S would be ashamed if he were to get low grades.
- .21 Q22 S considers seduction is a grave sin even when done in order to obtain information for one's country.

The picture here is very clear. The first six items are as predicted and all involve easily induced emotion although of diverse kinds. Only the last item does not have an obvious emotional aspect. Note that despite the worry item with the highest loading this factor cannot be interpreted as anxiety.

Factor 3: Self-sentiment or Material Aspiration (Variance 1.503).

- * .65 Q 3 S wants to be a leader in his profession.
- * .56 Q10 S wants to make a creative contribution to the world.
- * .42 Q24 S is keen to obtain top marks.
- * .37 Q17 S is aiming at obtaining a higher degree.
- .33 Q33 S wants to satisfy his sense of duty to the community and his country.
- .29 Q 2 S does not consider one should be overconcerned about the respect of others.
- .23 Q23 S knows at least one person whose moral behavior he would like to equal.

The four highest loadings are as predicted and reliably identify the factor. The remaining variables have obvious links with personal reputation. Q23 and

Q33 have significant loadings on the related ego-ideal factor, while Q2 seems to reflect the need to compromise in pursuing material ambitions. Note a similar situation with regard to Factor 7, Expediency.

This factor has an obvious similarity to the Self-sentiment factor of Cattell and Horn (8), which also stresses self-respect and professional proficiency.

Factor 4: Compassion (Originally hypothesized as "loyalty") (Variance 1.391).

- * .54 Q14 When *S* sees a fluffy kitten he has a desire to fondle and stroke it.
- * .49 Q26 *S*'s conscience continually nags even when he can find justification for an action he considers to be wrong.
- * .48 Q18 A sad story brings tears to *S*'s eyes.
- * .35 Q 7 *S* refrains from any action that may hurt the feelings of others.
- * .24 Q36 *S* considers that to betray a friend is more reprehensible than breaking an abstract moral law.
- * .23 Q21 *S* would not discourage the keeping of pets.
- .23 Q 2 *S* would not willingly do anything by which he might lose his self-respect.

All the predicted variables get significant loadings on this factor. The high loading on Q26 is interesting in its suggestion that the pangs of conscience may owe much to strong parental drive. Failure to establish an affectionate relationship to the parents in the early family situation may, therefore, reduce susceptibility to guilt quite apart from its effect on the development of the super-ego. Alternatively we may consider that the actual development of the super-ego is a function of the strength of affection. The latter view has much to commend it. It implies that guilt is a product of love rather than of fear, and this may explain why forgiveness and redemption have played such an important part with regard to guilt.

It is suggested that the Cattell and Horn Factor 11 (Narcistic Self-development) has been given a misleading title and is equivalent to what the authors have just described.

Factor 5: Religious Super-ego (Variance 1.330).

- * .55 Q32 *S* believes that an action is either right or wrong in the eyes of God.
- * .52 Q 1 *S* attends church frequently.
- .29 Q 7 *S* refrains from any action that may hurt the feelings of others.

- .29 Q 5 *S* finds difficulty in deciding what he ought to do.
- .28 Q16 *S* hopes that he will always be able to control his behavior.
- .25 Q 2 *S* would not willingly do anything by which he might lose the respect of others.
- * .24 Q15 *S* believes Oedipus's action inexcusable despite his ignorance of his mother's identity.
- * .21 Q22 *S* considers seduction is a grave sin even when done in order to obtain information for one's country.

Four of the six predicted variables appear on this factor. One of the others has gone to the second super-ego factor, while the other gets a significant loading on the expediency factor only. It is interesting that, while examples of ends possibly justifying the means (Q15 and Q22) get loadings on the present factor, a general statement that the end justifies the means is not picked up. Presumably, when stated in this bald form, most subjects fail to discern the implication that this involves a rejection of absolute moral law.

That the present factor relates to super-ego function, and that it indicates a strong religious basis for the factor, seems inescapable. Our expectations of the religious role are confirmed, but there is a further factor (F 10) which appears to represent the super-ego and which is devoid of religious relationships. We can only conclude that, while religion is very important with regard to the super-ego formation of many subjects, it is not a necessary component.

This agrees well with the Cattell and Horn Factor 39, Attitudinal Super-ego.

Factor 6: Ego-ideal (Variance 1.113).

- * .48 Q16 *S* hopes that he will always be able to control his behavior.
- .41 Q19 *S* considers that it is easy to have clear-cut priorities which guide one's behavior.
- * .40 Q23 *S* knows at least one person whose moral behavior he would like to equal.
- * .37 Q 9 *S* frequently denies himself things because he believes this is better in the long run.
- * .25 Q33 *S* wants to satisfy his sense of duty to the community and his country.

All except one of these variables are as predicted. One of the missing predicted variables is just below the level of acceptance (.199), while the other has gone completely over to the control factor. This is Q28, which involves shame because of failure to live up to ideals. In writing the item it

was not realized that such shame was dependent on *not* living up to ideals so that the person with a strong ego-ideal would not have cause to feel shame. Had it been stated as, "If I failed to live up to my ideals I should feel great shame," the authors might have expected it to load the present factor. As actually stated, the high likelihood of shame is cancelled out by the low likelihood of actual failure.

Again, confirmation of the factor seems all one could reasonably ask for.

Factor 7: Expediency (Variance 1.018).

- .54 Q37 *S* wants to be prosperous.
- .51 Q27 *S* believes that the end may justify the means.
- .35 Q22 *S* believes that seduction is justified when done for one's country.
- .26 Q 1 *S* does not go to church frequently.

This factor was not predicted, but it is remarkably self-explanatory. The urge for material success fits quite well with the ethics of expediency, while the absence of church-going in this syndrome would gladden the heart of a theologian. We now find that it has a rather strong resemblance to the Cattell and Horn Factor 9 (Expansive Nonconformity).

Factor 8: Vacillation (Variance .998).

- .49 Q29 *S* daydreams of success.
- .44 Q39 *S* swings from being very happy to being very sad.
- * .26 Q12 *S* changes his mind after making a decision.
- .25 Q 8 *S* would commit a mild dishonesty for a friend.
- .23 Q33 *S* has not got a strong sense of duty to the community and his country.
- .22 Q11 *S* easily becomes panicky.
- * .21 Q19 *S* does not find it easy to have clear-cut priorities.
- .20 Q14 *S* desires to fondle and stroke a fluffy kitten when he sees it.

Two of the three integration variables appear here, while the third one gets a loading of .195, but this factor is rather wider than what the authors had in mind. It seems to include several sources of indecision: emotionality, lack of strong super-ego, loyalty in conflict with moral principles, and perhaps lack of drive.

Factor 9: Antisocial Bias (Variance .965).

- .43 Q33 *S* has not got a strong sense of duty to the community and his country.

- .41 Q25 *S* is embarrassed in social situations.
- .40 Q21 *S* would discourage the keeping of animals as pets.
- .24 Q11 *S* easily becomes panicky.
- .22 Q38 *S* does not experience an intense thrill of delight in aesthetic contemplation.
- .21 Q26 *S*'s conscience continually nags even when he can find justification for an action he considers to be wrong.

No predictions were made. The pattern suggests an emotional recluse with a chip on his shoulder.

Factor 10: Nonreligious Super-ego (Variance .904).

- .43 Q24 *S* is not worried about getting top marks.
- .40 Q34 *S* would be sorry if he failed but not ashamed.
- .39 Q 8 *S* would not commit a mild dishonesty for a friend.
- .32 Q15 *S* believes Oedipus's action inexcusable despite his ignorance of his mother's identity.

This appears to be a somewhat attenuated Super-ego factor. There is the insistence on absolute ethics to which reference was made earlier, but there is no religious reference and a cold indifference to material success. One glimpses the person who would do his duty regardless of all else.

This may correspond to the second Super-ego factor of Cattell and Horn (F6), which gets high loadings on the 16 PF Factor G but has no religious implications.

E. CONCLUSIONS

It may be contended that this study provides justification for several important postulates:

1. Behavioral control is a joint function of strength of emotional reactivity ("emotionality") and the development of a positive ego-control learned via the process of what Freud called "reality testing." This distinction is an important one from the point of view of the psychotherapist.
2. There is an "absolute" moral system which appears in two forms, one with strong religious reference and one without. This appears to be the Super-ego function of Freudian theory. Cross-cultural studies would be most interesting in this respect.
3. The self-sentiment appears in both material and moral forms. The latter corresponds to the classical notion of ego-ideal. There is probably appreciable correlation between these two forms, but the authors' analysis does not permit them to assess this.

4. There is an important reference system centered on parental drive. This is the basis of loyalty as opposed to duty and is probably a potent source of moral conflict.

5. Finally, the authors would note two important behavioral traits which must be taken into account when predicting behavior, but which are probably not so fundamentally part of the ego-system. These are a bias toward expediency, and vacillation. The latter may be just a product of several causes rather than a true factor.

F. SUMMARY

Freud's "ego-ideal" and "super-ego," McDougall's "sentiment of self-regard," and later studies of the function of "conscience," suggest that a number of factors may be involved in this aspect of personality functioning. Seven factors (super-ego, ego-ideal, self-sentiment, loyalty, integration, ego-control, and emotionality) were hypothesized as operating in this area. A factor analysis based on 269 subjects yielded 10 factors: ego control, emotionality, self-sentiment or material aspiration, compassion or loyalty, religious super-ego, ego-ideal, expediency, vacillation, antisocial bias, and nonreligious super-ego. Six of these clearly corresponded with the hypothesized factors, a seventh (vacillation) was somewhat broader than expected. The clear distinction between the two "super-ego" factors and "the sentiment of self-regard" (self-sentiment) is worthy of note.

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PERCEPTUAL AND MOTOR DISCRIMINATION IN PSYCHOTIC AND NORMAL CHILDREN*

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A. INTRODUCTION

Describing the syndrome of childhood psychosis, clinicians have emphasized the apparent inability of affected children to structure and make appropriate use of sensory stimuli. Experimental results have supported this view, showing that such children have greater difficulties than either normal or subnormal controls in solving discrimination problems [see Hermelin and O'Connor (6) and Gillies (3)]. On the other hand, the relatively good motor abilities of such children have been noted (4, 11) and experimental results have suggested that tasks in which motor performance predominates are easier learned by them than are tasks with strong visual components (5, 6). This seems to suggest differential impairment of input compared with output mechanisms. While visual discrimination may require the integration of sensory input, organization of output might be more important in the learning of motor habits.

Experiments with animals, such as those of Warren (14, 15), suggest that position learning may not depend on the same pattern of abilities required by visual discrimination tasks. There also exist interspecies differences in the facility with which different discrimination problems are solved. Rats and cats learn position discrimination faster than object discrimination (1, 10, 13). For subnormal human subjects, House and Zeaman (7) and Zeaman and House (16) found that position discrimination was easier to learn than either color or shape discrimination tasks. In the following experiment normal and psychotic children of like mental age were compared for their ability to solve length discrimination and position discrimination problems.

As normal children were thought to be more efficient in the processing of visual information than were psychotics, the former might be expected to achieve a better level of performance than the latter on a length discrimination task. On the other hand, this same characteristic of the normals—i.e., the awareness of visually presented length differences—might make it more difficult for the latter than for the psychotics to ignore the negative length

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dimension in position learning. Such a result has been reported by Warren (12) for monkeys.

A further prediction was that in a series of stimuli varying in length, the longest and shortest ones would be selected more often than the two middle-sized ones; and correspondingly in position discrimination, the extreme right or left positions might differ in ease of position learning from the two middle ones.

B. SUBJECTS

The subjects were 32 psychotic and 32 normal children. The psychotics were selected in accordance with the presence of behavioral items listed on a check list developed by Creak *et al.* (2). No attempt was made to establish subcategories, so that according to a definition, such as Rimland's (11), autistic as well as schizophrenic children were included. The selection was made on the basis of observable behavior only, as historical and neurological information proved unreliable. The psychotics had a mean chronological age of 11 years, ranging from 6 to 15 years. For the purpose of the present experiment, matching with a normal group was carried out on the basis of time scores obtained on the Seguin form board. The scores of the psychotics on this perceptual motor intelligence test ranged from 17 seconds to 40 seconds, with a mean of 27 seconds. The mean score of the normals was 29 seconds, with a range from 17 seconds to 45 seconds. The normal children had a mean chronological age of 4 years, 4 months ranging from 3 years, 3 months to 5 years, 1 month. They attended a day nursery, while the psychotics were all institutional.

C. EXPERIMENT 1

1. Procedure

The material consisted of four upturned aluminum boxes, 1 inch high and 1.5 inches wide. They differed in length from each other by a constant amount of 1 inch, ranging from 6 inches to 3 inches. They were placed on a table in a line, with a distance of 4 inches between any two. For the visual discrimination task, a piece of candy was placed under a box of a particular length, independent of its position in the series which was varied from trial to trial. For the position discrimination a piece of candy was placed under a box in a particular position, independent of length which varied from trial to trial. There were four tasks. In the first of these either the selection of the extreme right hand or left hand stimulus was rewarded for alternate subjects. For the second, the half left or half right position was rewarded for alternate subjects. These were the two position discrimination tasks. In the length discrimination tasks

the rewarded responses were those to the longest or shortest of the boxes, and to the second longest or second shortest. Thus in addition to comparing the subjects on position and length discrimination, the relative difficulty of selecting either the extremes or the middle of a series in respect to length and position was investigated. The position of the stimuli in the length discrimination, or the lengths of the stimuli in the position discrimination, were varied over 48 trials by using twice all possible combinations of digits one to four.

Subjects were tested individually. Each had to learn one of the four tasks in a session lasting approximately 20 minutes. The eight subgroups of eight subjects were matched for chronological age within the normal and psychotic subgroups, and all groups were matched for Seguin time scores. For a first trial a piece of candy was placed under the correct stimulus in full view of the subject, who was asked to find it. A screen was interposed between each of the 48 subsequent trials, while the stimuli were rearranged. No correction for incorrect responses was allowed. Between trial intervals were of approximately five seconds duration, and no verbal instructions or comments were given.

2. Results

The data used for analysis were the number of errors made out of a possible total of 48. An analysis of variance compared psychotics with normals on position and length discrimination scores for the middle or end stimuli of the series. This showed that normals performed better than psychotics on all tasks ($p = .05$). The predicted groups-by-conditions interaction was not found, as both groups performed significantly better ($p = .001$) on the position discrimination than on the length discrimination tasks. A significant interaction ($p = .05$) between serial position and conditions demonstrated that, while the serial position of the correct stimulus made significant difference in length discrimination, this was not the case in position learning. Subsequent t -tests showed that for both groups length discrimination was not significantly more difficult than was position discrimination, provided the correct stimulus was either the longest or the shortest in the series. If, however, the correct response consisted of selecting either the second longest or second shortest, the tasks became significantly more difficult.

D. EXPERIMENT 2

In the first experiment each task represented a positive dimension—i.e., length or position—and correspondingly one negative one—i.e., position and length. The results showed the relatively greater ease in learning the position

discrimination while ignoring length, as compared with learning to select a stimulus according to length while ignoring its position. This was the case for normals as well as psychotics, and the predicted groups-by-conditions interaction had not been found. An interpretation of the results would thus have to be made in developmental rather than in clinical terms. In this experiment responding to position, while ignoring length, seemed to have been easier than ignoring position and responding to length. The same result had been reported by Warren (13) for cats. On the other hand, monkeys with prior experience of object discrimination showed the reverse pattern, and learned an object discrimination with varying positions more easily than a position discrimination with varying objects (12). Both monkeys and cats had performed better on position discrimination with two identical than with two different varying objects.

In order to investigate whether length variation had any distracting effect for children in learning a position habit, a second experiment was carried out using four aluminum boxes of identical length. They were 1 inch high, 2 inches wide, and 4 inches long. If size differences had been completely ignored in the previous position discrimination task, no difference in scores would be expected whether boxes of varying length or of identical length were used. If, on the other hand, the dimension of varying length had been appreciated, using the same length boxes for a position discrimination task should be easier and result in improved performance.

1. *Procedure*

The same 64 children as in the first experiment acted as subjects. Those who had been presented previously with the length discrimination test now had to learn a position habit, while those who had been learning a position discrimination were now required to solve a length discrimination problem. As previously, subjects responded either to the end or middle stimuli of the series: i.e., shortest and longest and extreme left or right, or second shortest and second longest and half left or half right. If either positive or negative transfer accounted for any resulting change in performance, then both groups should be equally affected, as all subjects had already been presented with one previous task.

If the scores obtained by subjects who did the position discrimination task with boxes of different length were the same as the scores of those who did the task with boxes of the same length, then the subjects, operationally speaking, might be said to have treated the two kinds of boxes as equivalent. When we consider the length discrimination tasks, there were no differences in the

material presented in the first and the second experiment. Under these circumstances, if the two groups obtained similar scores it would provide a check on the initial matching of the groups.

2. Results

The data for analysis were again the total number of errors out of a possible 48. Analyses of variance resulted as previously in a significant conditions-by-serial-place interaction. Response to the two middle-sized stimuli was significantly more difficult than response to the largest or smallest, or to any of the position tasks. The main effect between the groups was not significant in the analysis; as compared with the previous experiment psychotics had somewhat higher and the normals somewhat lower scores.

There are no significant differences when the results of the two experiments are compared by analysis of variance. Subjects perform similarly whether presented with length discrimination before or after a position discrimination. Likewise there is no difference in performance of position discrimination, whether this follows or precedes a length discrimination task. Scores on position learning with stimuli of the same or differing length do not differ significantly.

There were only six children out of the 64, three normal and three psychotic, who did not learn the position habit to a criterion of 10 consecutive correct responses. On the other hand, 20 psychotics and 15 normals failed to reach this criterion in the length discrimination tasks. While it had been established that length differences did not detract from the learning of position discrimination, the question whether position habits might interfere with the learning of a length discrimination remained to be answered. The responses of the 35 subjects who had failed to learn the length discrimination were therefore analyzed for alternative response patterns. There was no marked tendency in either group to persist with position responses to one particular stimulus. Sixty-six per cent of the responses by the psychotics and 71 per cent of those of the normals were changed after one trial, and 92 per cent and 94 per cent, respectively, after three trials. Thus in the length discrimination tasks long runs to any one particular position scarcely occur at all.

Of those who did not solve the length discrimination problem, the 20 psychotics gave a total of 960 responses and the 15 normals a total of 720. An analysis of variance tested whether the same number of responses had been directed to the extreme right and left position and the two middle position stimuli. This showed that both groups made significantly more responses to

the two stimuli in the middle position than to the two on the extreme right and extreme left.

E. DISCUSSION

It had been predicted that normal and psychotic children would differ in the ease with which they learned discrimination habits, according to whether this learning depended on the relative predominance of either input or output capacity. While it was realized that both processes were represented in the two conditions used, length discrimination was thought to depend mainly on the analysis of input data. Position discrimination is essentially the learning of a motor habit, and this can be thought of as the organization of movement or output. Because of the apparent imperception of many psychotic children on the one hand and their relatively intact motor capacity on the other, it was predicted that normals would be better than psychotics in learning a length discrimination, while the reverse might be the case in position discrimination learning. This prediction would result in a groups-by-conditions interaction in an analysis of variance, which in fact was not present in the results. Normals as well as psychotics found it easier to learn the position than the length discrimination, and the difference in scores between those conditions was the same for both groups. Therefore an interpretation of the results must be thought of in developmental rather than in clinical terms. The organization of motor movements and the analysis of kinesthetic feedback may be prior to their interaction with visual input data. This may be so for animals and young children as well as for those with impaired cognitive functions. This interpretation is supported by the finding that, while irrelevant input in the form of variation in length did not interfere with the learning of a position discrimination, position response tendencies hindered the learning of a length discrimination.

Warren (12) found that monkeys learned fastest when the task was the discrimination of two different objects remaining in the same position throughout learning. This is in agreement with Miller's (9) results in humans, that discrimination is made easier by increasing the number of dimensions that differentiate stimuli. The monkeys also learned easily to discriminate two identical objects according to position. On the other hand, they made significantly more errors when position problems had to be solved with two different, randomly varied objects. For cats (13) position learning with two identical objects was easier than with two different ones, whether these were varied randomly or remained in the same position throughout. The cats seem to have been distracted by the irrelevant dimension of object

difference. All these results suggest that the animals perceived the difference between objects during position learning. No such indication is given by the results of the present experiment, in which there was no difference in position learning scores in a task using identical stimuli and one where the stimuli varied in length.

Turning to the length discrimination problem, those subjects who do solve the tasks do so in fewer trials if the correct stimulus is either the longest or shortest of the series. An explanation for this may be given in terms of Inhelder and Piaget (8), describing an experiment where children are presented with a collection of sticks of different length. The longest of these is placed in front of the child and he is asked to draw the one that comes next in length, then the next, and so on to the shortest of the series. Children who were able to do this were yet unable to use the sticks themselves rather than draw them, to produce such a series. Inhelder and Piaget explain these results by pointing out that the actual seriation involves the element of reversibility, while serialization in the drawing does not. In making the drawing, the child only has to make a single comparison: i.e., each line has to be shorter than the one preceding it. On the other hand, in actually ordering the elements, each one except the tallest and the shortest is shorter than some and longer than other sticks. Thus a simultaneous comparison has to be made, where a certain element is both shorter than the ones already in the series and longer than those that remain to be ordered. The required operation thus becomes multidirectional or reversible. This interpretation applies directly to the authors' findings. The shortest and longest of the boxes are shorter or longer than all the three remaining ones and a unidirectional comparison is all that is needed. Each of the two boxes of intermediate length on the other hand is longer than some and shorter than others and a multidirectional comparison is needed to solve the problem. The difference between the performance on the two types of length discrimination tasks—i.e., intermediate and extreme lengths—is therefore explicable in terms of cognitive stages of development.

Position discrimination is equally easy whether the correct response has to be directed toward the extreme right and left, or the half right and half left stimulus. The apparently high error score of the psychotics in one of the position learning tasks is due to the extremely bad performance of one subject. However, those subjects who could not learn a length discrimination directed their responses more often toward the middle than toward the end position stimuli.

We are not aware of any other psychological experiment in which the

behavior of psychotic and normal children could be understood in terms of mechanisms applying to both groups. It is sometimes assumed that the behavior of psychotic children may be so bizarre that it is difficult or impossible to perceive structure and consistency in it. In the present study the results obtained from these children were neither quantitatively nor qualitatively much different from those of a group of younger normals. It is thus suggested that an interpretation of the results be sought in cognitive developmental terms.

F. SUMMARY

Normal and psychotic children of like mental age were compared for their ability to learn position and length discrimination problems. Position learning was further investigated by using identical as well as differing stimuli. It was found that all subjects learned position discrimination faster than length discrimination, and that there was no difference in position learning according to whether identical or different stimuli were used. While length discrimination was easier when the shortest or the longest of four boxes was the rewarded stimulus, the middle positions rather than the extreme right or left were easiest in position learning. The results are explained in cognitive developmental terms.

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STUDIES OF PUNISHMENT RELATING OMISSIONS IN NOXIOUS STIMULATION TO RESPONSE REVERSALS*

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A. INTRODUCTION

A greater degree of resistance to extinction occurs with intermittent reinforcement than with continuous reinforcement. This has been observed in a variety of consummatory and aversive learning situations. Mowrer (11) reviewed the experimental data on intermittent reinforcement and has discussed them from the standpoints of the response-unit and discrimination hypotheses.

The present paper is limited strictly to the problem of intermittent reinforcement in aversive learning, and specifically to the effect on animal running behavior produced by omissions in noxious stimulation. Aversive procedures of the latter type have been described initially by Hunter (3), Estes (2), and Sheffield and Temmer (13).

Sheffield and Temmer (13) found an increased resistance to extinction for an avoidance group when comparing running responses under escape and avoidance conditions. Jones (4) found the same increased resistance to extinction for running under avoidance, limited avoidance, and intermittent escape conditions. With running behavior under a response reversal criterion, Kolstoe, Kleban, and Utecht (7) confirmed the increased resistance to extinction for omissions in noxious stimulation. Kleban (6) also found that varying ratios of omissions in noxious stimulation produce the same level of resistance to extinction.

There are several theoretical positions that have been forwarded to explain the increased resistance to extinction produced by omissions in noxious stimulation. Sheffield and Temmer's (13) generalization decrement hypothesis and Miller's (10) and Kleban's (6) fear postulations all explain these phenomena.

Both Sheffield and Temmer's and Miller's positions, despite their basic differences, have one theoretical characteristic in common. They assume that

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omissions in noxious stimulation allow different and otherwise neutral stimuli from those associated with the running response under noxious stimulation to become conditioned to produce the running response. Their positions also rest upon the notion of the similarity of stimuli between those present during the omission trials and those characteristic of extinction trials. As a result, it would be asserted from these positions that any omissions in noxious stimulation would result in increased resistance to extinction because the omission trials allow neutral stimuli, similar to extinction trial stimuli, to develop the capacity to produce and maintain running.

Kleban's position is distinctly different on this point. The conditioning of neutral stimuli during the omission trials is regarded as relatively unimportant in comparison to stimuli emanating from and indigenous to the running response itself. An automatic conditioning of the fear reaction to the afferent stimuli produced by the act of running is postulated to occur during the shock omissions [see Kleban (6)]. Thus, the same stimuli from the running response are associated with two reaction tendencies, one a pure fear reactivity introduced by the omission trials and the other a blended pain-fear reaction [see Miller (9)] produced by the electric shock. As a result, Kleban would predict that any omissions in noxious stimulation would not necessarily produce increased resistance to extinction. That is, if the omission experiences are followed strictly by escape trials, the resulting resistance to extinction would be similar to that found under escape training.

The paper reports a series of five experiments, three of which are described in some length. Experiment I is addressed to the theoretical problem outlined above. Experiments Ia, Ib, and II were undertaken to explore the reasons for the findings in Experiment I. Also, Experiment Ia produced results contrary to previous data on omission in noxious stimulation. In Experiment II, the reason for the contrary data was established and Experiment III was related once again to the original theoretical problem.

B. EXPERIMENT I

The experimenter will use the term "50 per cent shock" to mean a noxious stimulation schedule in which one-half the trials are no-shock trials, and "100 per cent shock" to mean that electric shock is administered on every trial.

The design of the experiment was to place 50-100 per cent and 100-50 per cent shock series back-to-back in a training sequence. There were 8/32, 20/20, and 32/8 ratios of 100-50 per cent and 50-100 per cent shock conditions, producing three conditions of 50-100 per cent shock and three conditions of

100-50 per cent shock. Sheffield and Temmer would assert no differences among these six conditions. The experimenter would take the position that no differences would occur for the 8/32, 20/20, and 32/8 groups under the 100-50 per cent shock conditions, but that there would be significant decreases in resistance to extinction for the 32/8, 20/20, 8/32 groups under the 50-100 per cent shock conditions.

1. Method

a. Subjects. The subjects were 45 male and 45 female Huntingdon Farm albino Wistar rats, 60-100 days of age at the beginning of the experiment.

b. Apparatus. The apparatus consisted of a closed Y-maze with a stem extending 20 inches to the choice-point. The grid floor, beginning in the starting box and terminating in front of the choice-point, consisted of $\frac{1}{8}$ -inch brass rods placed $\frac{1}{2}$ -inch apart. The maze was constructed with wood and painted flat black in the stem and white in the arms. Guillotine doors were placed in the starting box and at the choice-point. The entire top surface of the maze was covered with removable Plexiglas panels.

The electric shock-inducing apparatus consisted of a 0-to-135 Variac wired to a 110-500-volt step-up transformer with a 220,000 ohm, 1-W, fixed resistor. The brass rods making up the grid were connected to two leads, every other rod being positive with intervening rods negative. The shock apparatus was controlled by a single pole, double-throw (off-on) switch.

2. Procedure

a. Pretraining. The animals were not placed on any type of drive schedule, nor did they receive any prehandling. On the first day of the experiment they were allowed to explore the maze for a 10-minute interval in groups of three.

b. Shock training. Five minutes after pretraining, the animals were started in the experiment. They were given a total of 41 shock trials, 11 on the first run and 10 on three successive runs. They were started off with an introductory, lower voltage shock on the first trial. The introductory shock was of 200-volt intensity, which served to establish running responses from the stem to the maze arms. Thereafter, the shocks were of 410-volt intensities. After the completion of each trial, the animals were removed without delay and returned to their experimental cages. At least one minute elapsed between any animal's successive trials.

In the 100-50 per cent groups, the 8/32 condition had the 200-volt introductory shock followed by omissions in shock on trials 9, 12, 14, 15, 18, 20, 22, 24, 25, 28, 30, 32, 34, 35, 38, and 40. For the 20/20 condition, the animals

experienced omissions in shock on trials 22, 24, 25, 28, 30, 32, 34, 35, 38, and 40. In the 32/8 condition, omissions in shock occurred on trials 33, 35, 36, and 39.

In the 50-100 per cent shock groups, the 8/32 condition had the omissions in shock on trials 2, 4, 5, and 8. For the 20/20 condition, omissions in shock occurred on trials 2, 4, 5, 8, 10, 12, 14, 15, 18, and 20. In the 32/8 condition, omissions were scheduled on trials 2, 4, 5, 8, 10, 12, 14, 15, 18, 20, 22, 24, 25, 28, 30, and 32.

Excluding the initial 200-volt shock, these experimental conditions contained different numbers of actual shock trials. In the 100-50 per cent conditions, the 8/32, 20/20, and 32/8 groups received respectively 24, 30, and 36, 410-volt shock experiences. In the 50-100 per cent groups, the 8/32, 20/20, 32/8 groups received respectively 36, 30, and 24, 410-volt shock experiences. Both Jones' (4) and Kleban's (6) results suggest that these absolute differences in punishments will not significantly alter the resistance to extinction produced by the omissions in noxious stimulation.

c. Response Reversal Trials. During the extinction trials, shock was discontinued and the animals were run for 20 trials per day. After each trial, the animals were removed from the arms and returned to the experimental cages. The criterion of extinction was one reversal to the opposite arm of the maze. Immediately after the fortieth trial, the animals' extinction trials were massed. The animals were taken from the maze arms and returned to the starting box.

3. Results

The mean scores for the 100-50 per cent conditions were 17.33, 28.13, and 17.27 for the 8/32, 20/20, and 32/8 groups. For the 50-100 per cent conditions, the mean scores were 23.20, 14.60, and 22.67 for the 8/32, 20/20, and 32/8 groups. The results were analyzed by a two-factor analysis of variance. There were no significant differences found for the main effects or for the interaction. The *F* ratios were .0356 (1, 84 *df*), .0451 (2, 84 *df*), and 2.5448 (2, 84 *df*) for the 100-50 per cent and 50-100 per cent shock conditions, the shock ratios, and the interaction analyses, respectively.

C. EXPERIMENT II

The results from Experiment I are in complete agreement with Sheffield and Temmer's (13) and Miller's (10) positions: that is, any omissions in noxious stimulation result in increased resistance to extinction.

Although the weight of evidence seemed conclusive, the experimenter was not satisfied to terminate the investigation at this point. The possibility

existed that no differences may have occurred because of confounding factors. For example, in a previous experiment, Kleban (6) found strain differences between albino Wistar and Albino Sprague-Dawley rats with respect to recovery from noxious stimulation.

As a result, the purpose of Experiment Ia was to establish baseline rates for Sprague-Dawley and Wistar rats under both 100 per cent and 50 per cent shock conditions. The age of subjects, apparatus, and procedure were

TABLE 1
CRITERION SCORES FOR EXPERIMENT IA

Item	Wistar rats		Sprague-Dawley rats	
	50%	100%	50%	100%
Criterion scores	1	1	5	1
	1	3	13	2
	4	13	18	3
	5	14	23	4
	11	28	24	4
	13	29	25	8
	13	31	26	10
	32	33	35	11
	33	34	36	25
	39	34	38	33
	41	43	38	42
	44	44	47	43
	50	46	58	44
	51	49	58	48
	53	61	62	59
Statistics				
N	15	15	15	15
Mean	26.07	30.87	33.73	22.47
Range	1-53	1-61	5-62	1-59

essentially the same as in Experiment I with the exception that the training trials were divided into two 20-trial periods. In the 50 per cent shock group, omissions in noxious stimulation occurred on trials 3, 5, 6, 8, 10, 12, 14, 15, 18, 20, 22, 24, 25, 28, 30, 32, 34, 35, 38, and 40.

The results of Experiment Ia can be seen in Table 1. The data were analyzed by a two-factor analysis of variance. The F ratios of .0344 (1, 56 df), .4523 (1, 56 df), and 2.7632 (1, 56 df) for the 50 per cent and 100 per cent shock, strains, and interaction conditions indicate the presence of nonsignificant differences. The finding of no difference between the 50 per cent and 100 per cent shock conditions was very surprising and contrary to the previous experimental evidence on omissions in noxious stimulation. The finding also nullified the meaning of the results and the support for Sheffield and Temmer's and Miller's positions presented in Experiment I (see Table 1).

Experiment Ib was undertaken to establish whether a procedural factor was responsible for the failure to find a difference in extinction scores for the 50 per cent and 100 per cent shock conditions. A 50 per cent shock schedule should produce more resistance to extinction than a 100 per cent shock schedule. This has been a reliable finding of previous experiments which has not occurred in Experiment Ia. It was reasoned that perhaps the immediate removal of the animals from the maze arms might be the factor obscuring the difference between the 50 per cent and 100 per cent shock conditions. Under the condition of immediate removal, the animals might have been responding to the overwhelming reinforcement of running to get out of the maze.

In Experiment Ib, the age of the subjects, the apparatus, and the procedure were the same as for the 100 per cent shock conditions of Experiment Ia. Fifteen Sprague-Dawley rats were run for twenty 100 per cent shock trials and a 30-second interval was used before the animals were removed from the maze on both the shock and extinction trials. Moreover, the animals were given a five-minute rest and then run to extinction.

These animals were compared to the thirty 100 per cent shock animals of Experiment Ia. A t -ratio of .5726, 43 df , clearly indicates a nonsignificant relationship. It does not matter whether the animals are removed from the arms immediately or after a 30-second interval. The reduction of the number of shock trials, moreover, from 40 to 20 trials, did not act to lessen the resistance to extinction. Even the greater clustering of trials did not produce sufficient fatigue or inhibition to produce any reliable difference between these two 100 per cent shock groups.

In Experiment II, the experimenter turned his attention to the scheduling and timing of the extinction trials. Previously, any two extinction trials were separated by at least a one-minute time interval in which the animals were returned to their laboratory cages. As a result, the decision was made to mass the extinction trials. It was reasoned that by facilitating extinction, the 50 per cent and the 100 per cent shock groups might extinguish at different rates in a manner parallel to the previous studies on omissions in noxious stimulation.

1. *Method*

The subjects were 30 albino Wistar and 30 albino Sprague-Dawley rats purchased from the Huntingdon Farms. They were 60-100 days of age at the beginning of the experiment.

The procedure was the same as Experiment Ib with the further exception that each animal was run under massed extinction conditions: that is, being removed from its maze arm and returned directly to the starting box. The

100 per cent shock group received shock on every trial and the 50 per cent shock group received shock on trials 1, 2, 4, 7, 9, 11, 13, 16, 17, and 19.

2. Results

The response reversal scores can be seen in Table 2. The data were analyzed by a two-factor analysis of variance. Under the conditions of massed extinction trials, a significant difference occurred between the 50 per cent and the 100

TABLE 2
CRITERION SCORES FOR EXPERIMENT II

Item	Wistar rats		Sprague-Dawley rats	
	50%	100%	50%	100%
Criterion scores	2	1	3	1
	5	1	3	1
	7	2	5	1
	9	2	6	2
	11	2	8	2
	11	3	8	3
	15	3	9	3
	17	4	13	4
	19	5	14	4
	23	8	16	4
	29	10	20	6
	30	10	20	6
	31	13	21	9
	34	31	38	13
	35	37	57	16
Statistics				
<i>N</i>	15	15	15	15
Mean	18.53	8.80	16.07	5.00
Range	2-35	1-37	3-57	1-16

per cent shock conditions. The difference between the 50 per cent and 100 per cent shock conditions appears reliable with an *F* ratio of 13.6354 (1, 56 *df*) which meets the required .01 level of significance.

D. EXPERIMENT III

With the development of the latter procedure, the aim was to return to the original focus of Experiment I. Because of limitations in funds, a complete duplication of Experiment I was not possible; instead, it was decided to use two groups of subjects, one receiving a sequence of 100-50 per cent shocks and the other receiving a sequence of 50-100 per cent shocks. It was predicted that under these conditions the 50-100 per cent subjects would show significantly earlier response reversals than the 100-50 per cent group.

1. *Method*

The subjects were 38 albino rats, both Sprague-Dawley and Wistar rats, purchased from the Huntingdon Farms 60-100 days of age at the beginning of the experiment. The procedure was modified once again: 25 shock trials were scheduled, followed by a five-minute rest period, and then by massed extinction trials. The 100-50 per cent group received ten 100 per cent shocks followed by shocks on trials 12, 14, 17, 18, 20, 22, and 25. The 50-100 per cent group received shocks on trials 1, 2, 4, 7, 9, and 100 per cent shocks on trials 11 through 25.

2. *Results*

The means for the 100-50 per cent and the 50-100 per cent groups were 17.45 and 8.15, respectively. There is a significant mean difference present, the *t*-ratio being 2.3425 which is significant at the .01 level, one-tail test.

E. DISCUSSION

By using a spatial discrimination situation to study intermittent punishment, the experimenter has obtained results that require a more complicated explanation than originally anticipated. The data cannot be explained by reference only to the comparison of intermittent and continuous punishment schedules.

The discrimination hypothesis (12), the generalization decrement hypothesis (13), and the fear explanations (5, 10) all predict that omissions in punishment produce increases in resistance to extinction. Under the conditions of Experiment Ia, in which the extinction trials were distributed, not a single theoretical position was confirmed. In Experiment II, however, all of these theoretical positions were confirmed. These contrary findings made it apparent that something in the extinction procedure itself was extremely influential in determining the duration of the extinction process.

In order to understand the seemingly contradictory findings in Experiments Ia and II, attention must be focused independently on the punishment schedules and on the response-reversal extinction trials. With respect to intermittent reinforcement, the findings of previous research (avoidance training, varying training ratios of intermittent escape, and limited avoidance training) have always supported Sheffield and Temmer's position that any omission in noxious stimulation increases resistance to extinction. These omission schedules, however, have always had one thing in common: they presented the animals with consistent expectations that omissions will occur throughout the entire shock schedule. This was not the case in Experiment III. The animals had the

omissions introduced either at the beginning or at the end of the punishment series. The major finding was that, under massed extinction conditions, the animals shocked continuously at the end of the series showed a marked decrease in resistance to extinction.

The latter finding is what would be expected from the standpoint of the discrimination hypothesis. Although the discrimination hypothesis can explain the data, it does not address itself to the problem raised by the experimenter: that is, in what way the running response becomes conditioned to persist in the absence of punishment. Sheffield and Temmer's and Miller's explanations are concerned with the manner in which the running response becomes stereotyped. From their positions, omission in noxious stimulation allows for the appearance of neutral stimuli which become conditioned to produce either the running response directly (Sheffield and Temmer) or fear reactivity (Miller). As a result, the appearance of omissions in noxious stimulation is regarded to be sufficient to increase resistance to extinction. To quote from Sheffield and Temmer: "Any procedure which introduces some omission of reinforcement during acquisition should tend to weaken the response during training but prolong extinction of the response" (13, p. 297). The results of Experiment III do not support this.

The experimenter takes the position, however, that the conditioning of neutral stimuli may occur but not with the great intensity assumed by Sheffield and Temmer or Miller. In the experimenter's thinking, moreover, much greater emphasis is assigned to the conditioning of the fear reaction to the proprioceptive cues emanating from the running response itself. As a result, so-to-speak, the animals are highly reactive to the appearance of either pain-fear or fear alone, thus making them sensitive to expectancies produced by the sequence of these two experiences. With the pain-fear experiences at the end of a punishment series, the animals begin to expect a continuation of the same pain-fear experiences, which produces expectancies similar to those formed in an escape situation. Despite the omissions in noxious stimulation at the beginning of the shock schedule, the animals readily reverse maze arms under massed extinction trials.

By massing the extinction trials, the animals become caught within an avoidance-avoidance conflict which produces the early response reversals. The process by which the massed extinction trials produce avoidance tendencies needs some explanation. Two types of explanation are possible, one emphasizing inhibition of response through fatigue and work, and the other stressing a learned avoidance response. Experiment Ia probably represents extinction under the conditions of inhibition of response, in which with the termination of

shock, the running response gradually wears out. In Experiment II, however, reversals occurred in markedly less trials, particularly for the 100 per cent group. The latter result represents reversals precipitated through developing aversions for the maze arms.

Aversive response-reversals can be subsumed under a theoretical position described by Martin (8). In the learning theory tradition of Spence (14) and Amsel (1), Martin outlines a position that is based upon fractional anticipatory reward ($r_r - s_r$) and punishment ($r_p - s_p$) responses. By way of definition, the $r_r - s_r$ and $r_p - s_p$ terms can be analyzed into their component parts. The r_r and r_p terms represent classically conditioned responses to the stimuli of instrumental settings. The s_r and s_p terms represent interoceptive stimulus cues produced by the classically conditioned responses (r_r and r_p) which in turn are assumed to become conditioned and thus to influence the ongoing instrumental behaviors.

A question remains about how the maze arms acquire aversive features. In Experiment II, the aversion was probably developed by temporal conditioning. By massing the extinction trials, the animals were taken from the maze arms and placed back into the starting box, a procedure that required less than five seconds. Thus the arms developed aversive characteristics by association with the fear arousing starting box.

In Experiment II, the development of $r_p - s_p$ responses played a major role in producing response reversals. During extinction, the running responses from the stem were maintained by fear of shock. The massing of extinction trials produced a fearfulness for the maze arms. On succeeding trials, anticipatory punishment responses ($r_p - s_p$) began to develop to the maze arms. With the increase in the intensity of $r_p - s_p$, it would follow that the animals would begin to reverse maze arms once $r_p - s_p$ produced sufficiently strong avoidance incentives.

The development of aversive responses to the maze arms may be produced by the conditioning of different negative emotions. In the experiment by Kolstoe, Kleban, and Utecht (7), there was a significant difference between response-reversal scores for the intermittent and continuous punishment groups. The experimenters used the notion of inhibition of response to explain the reversals. In the light of Experiment II, there might not have been any difference between the groups if extinction had occurred by inhibition of response. In retrospect, response-reversals might have occurred instead because of the frustration developed by the removal of food. Martin's theory could be applied as follows. During extinction the animals run from the stem because they continue to be fearful of shock. The selection of maze arms, however, would be determined

primarily by the relative strengths of the $r_r - s_r$ and $r_p - s_p$ responses. When $r_p - s_p$ decidedly exceeds $r_r - s_r$ in strength, it would follow that the animals would begin to make response-reversals. The difference found between the intermittent and continuous punishment groups might have been observed only because of the development of frustration during the extinction trials.

F. SUMMARY

The present paper includes five experimental studies which deal with the effects of intermittent punishments on resistance to extinction. The purpose was to test the assertion that any omissions in noxious stimulation would produce increased resistance to extinction. It was predicted that the 50-100 per cent shock schedules would not produce increases in resistance to extinction.

The apparatus was a Y maze with an electric grid as the floor of the stem. In Experiment I, albino rats were forced to make running responses under the pressure of 100-50 per cent and 50-100 per cent intermittent punishment schedules. These schedules were selected so that the results would enable a choice between theoretical positions.

In Experiment I, no differences were found among the 100-50 per cent and 50-100 per cent shock conditions. These results favored Sheffield and Temmer's and Miller's positions. Experiment Ia was conducted to establish a baseline for comparing the behavior of Sprague-Dawley and Wistar albino rats on the 100 per cent and 50 per cent shock schedules. There were no differences found between the two strains and between the 100 per cent and 50 per cent shock conditions. The latter finding pointed out clearly that the absence of differences in Experiment I was the result of no difference between the 100 per cent and 50 per cent schedules: that is, the experimental situation itself was not producing behaviors that could be used to test the theoretical positions.

The problem then focused on what was preventing the differences from occurring between the 100 per cent and 50 per cent shock groups. The timing of the removal of the animals from the maze was eliminated as a confounding factor (Experiment Ib). In Experiment II, under massed extinction conditions, the difference between the 100 per cent and the 50 per cent shock groups was significant. This finding was consistent with the previous work on omissions in noxious stimulation. With the procedure of Experiment II, it was found in Experiment III that a 50-100 per cent shock schedule produced less resistance to extinction than did a 100-50 per cent shock schedule. The latter finding was confirmatory for Kleban's hypothesis and in opposition to the theories of Sheffield and Temmer, and Miller.

The data were rather complicated to explain and had to be discussed from

several theoretical positions. Martin's $r_r - s_r$ and $r_p - s_p$ concepts were introduced to explain what was happening during extinction, and avoidance-avoidance conflict was used to explain the findings in Experiment II.

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THE PERSONALITY AND CHARACTER STRUCTURE OF THE DELINQUENT: SOME SOCIAL PSYCHOLOGICAL IMPLICATIONS*

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A. INTRODUCTION

In 1963 Pierson and Kelly (16) published the results of the administration of the High School Personality Questionnaire (HSPQ) to the entire delinquent population of one state (Washington). This article was followed shortly thereafter by another (17) which uttered the bold and controversial statement that the delinquent was below average in anxiety. This finding was diametrically opposed to the view held by almost all modern and "progressive" facilities occupied with the treatment of delinquency (8). Both of these authors observed in no uncertain terms a strong and indeed hostile and almost irrational reaction to the above findings by the social work profession particularly, but by no means was this negative reaction confined to that profession. There has, however, been a great deal of interest in these articles from abroad. Two hundred reprints of each article were exhausted and ditto copies were mailed to interested scientists from all parts of the world. To this day, however, those findings have never been put into practice where they were discovered. The authors have also concluded that one cannot be a prophet in one's home town.

A great deal of water has gone under the bridge since "HSPQ norms on a statewide delinquent population" was published. Furthermore, the research upon which that 1963 publication was based was begun as early as 1961. Thus five years have lapsed since the original work was done. Also a new edition of the HSPQ appeared in 1963, which offered a middle choice rather than the forced choice questionnaire format of the earlier 1958 edition (4, 5).

Pierson and Kelly (16) offered a tentative equation (DELST) to predict the degree of delinquent potential of the individual, and other work with

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the HSPQ has been reported since then (14, 15, 17, 19). One article in press with the *Journal of Social Psychology* (19) has used that instrument to observe changes in personality that result from treatment. However, one large and critically important question loomed ominously over all subsequent research in delinquency with this instrument: does the new (1963) edition of the HSPQ discriminate delinquents from nondelinquents as did the 1958 edition? The present work aims to answer that question and to examine a few of the social psychological implications of the present findings.

B. METHOD

The High School Personality Questionnaire, HSPQ, is a factored personality instrument that assesses essentially the same personality factors as the more extensively used and familiar 16 Personality Factor Test, 16PF (6). Its age range extends from the seventh grade through senior high school (roughly age 12 through 17). It was thus ideally suited for the population under study, which will be subsequently described. The instrument purports to measure the full range of personality source traits and includes an intelligence measure, factor B (1, 3, 7). The factors are labeled A, B, C, D, E, F, G, H, I, J, O, Q₂, Q₃, and Q₄. A more comprehensive discussion of these factors is available in various textbooks and handbooks (1, 5). These instruments were developed following the research and theories advanced by Professor Raymond B. Cattell.

The subjects were 338 male juveniles ranging in age from 14 to 17 years who were committed to the Washington Department of Institutions, Division of Juvenile Rehabilitation. The tests were administered to all boys admitted to the division. About 80 per cent of the total admission are boys (20). For all practical purposes we may therefore regard juvenile delinquency, as legally defined, as a male phenomenon. Pathology expressed by girls tends to be of a more intrapunitive, self-destructive nature than that expressed by boys, and thus often escapes legal attention. All subjects for this study were first received at the Division's diagnostic center and subsequently assigned to Green Hill School (GHS) in Chehalis, Washington. This means that these individuals met three criteria: (a) they were male, (b) they ranged in age from 14 to 17 years, and (c) they were more aggressively acting out and were regarded as being more seriously character disordered than were other delinquents. This sample may thus be regarded as the most clearly defined population of delinquents in the State of Washington. It will be recalled that the earlier normative data (16) used the entire population of delinquents of the State of Wash-

ington. This sample has been accordingly restricted to those assigned to GHS to provide a sample with maximum possible bias in terms of delinquency.

Means and standard deviations were computed for each of the 14 factors, and these were compared with the total normal sample upon which the test was standardized [see Cattell and Eber (5)]. The *t*-test was computed for each factor. The results are shown in Table 1.

TABLE 1
RESULTS OF COMPARING SUBJECTS AND NORMAL SAMPLE ON 14 HSPQ FACTORS
(*N* = 338)

Factor	<i>M</i> _{diff}	<i>t</i>	Significance
A ^a	+ .37	3.29	.001 ^b
B	— .216	1.77	n.s.
C	+ .86	6.84	.001
D	— .58	3.63	.001
E	+ .90	7.20	.001
F	— .26	1.01	n.s.
G	— .05	.38	n.s.
H	+ .06	1.17	n.s.
I	+ .45	4.30	.001
J	+2.32	20.90	.01
O	— .53	3.06	n.s.
Q ₂	+ .13	1.55	.001
Q ₃	—1.44	10.40	n.s.
Q ₄	— .06	.19	n.s.

^a The meaning of these factors is discussed in the text.

^b See McNemar (12).

C. RESULTS

Table 1 reveals that eight factors most significantly distinguish the delinquent group from the total sample upon which the HSPQ was standardized. These are factors A, C, D, E, I, J, O, and Q₃. This leaves factors B, F, G, H, Q₂, and Q₄ not significantly different from the standardization sample. A discussion of these findings by factor will be given.

D. DISCUSSION

1. Factor A

This factor was found to be most significantly above the population mean in both this study and the earlier study quoted above (16). This is a "large" factor of broad influence and accounts for a great deal of behavioral potential. Adjectives, such as the following, give something of the gist of the dimension: warm, friendly, sociable *versus* critical, reserved, distant, formal. Those not

personally familiar with the delinquent and who depend upon the black leather jacket stereotype to identify this group may be surprised at this finding. One needs only to observe the delinquent in his own peer group to realize that he is really a sociable person and when under control quite friendly to adults whom he trusts. Furthermore, one needs to remember the cyclothymic qualities of undependability and lack of persistence to round out the picture. One need encounter only once the handshaking, warmly friendly, back-slapping confidence artist to appreciate the cyclothymic nature of the character disordered delinquent. This is a dimension upon which all persons vary, so of course other factors are needed to make the diagnosis. All cyclothymics are obviously not delinquent. Some are very successful automobile salesmen, for example.

2. *Factor B*

This factor in the present study is not significant. B is general ability and this is the third study by the present writer (16, 18) which indicates that the intellectual level of the delinquent population does not differ from the normal. There is, however, an almost universal belief that the delinquent is below average intellectually. There is no question that this group is handicapped in terms of academic achievement, reading ability, and verbal skills, but they are not stupid. This statement can be made both with respect to research findings and clinical experience. B factor measures less of the purely verbal crystallized ability than do more traditional tests used in many school settings, and this coupled with poor academic achievement probably accounts for what many may consider an affront to the obvious. This finding suggests that new and different educational methods will need to be developed for this group, and indeed there is some indication that these are being sought after in some quarters (13, 18, 19).

3. *Factor C*

As was discovered earlier (16), this factor in the delinquent group is found to be significantly far above average. Simply stated, this means that the delinquent is not a neurotic. He is an entirely different breed of cat, as the present data indicate. Ask anyone whose orientation is primarily psychoanalytic where the delinquent stands in terms of ego strength and neuroticism, and the answer will inevitably be that he is below normal [see for example Grossbard (10), Hall and Lindzey (11), and Eissler (8)]. This premetric hypothesis has in the field of delinquency magically become regarded as a confirmed fact. The fact that this view of ego definitely is inconsistent with replicated research has gone largely unnoticed or ignored. The therapeutic chaos that results from

treating one diagnostic group with an armamentarium of techniques designed for another was recently cogently illustrated (19). Perhaps these findings will be synthesized in the next generation into a rational system of treatment that is based upon the personality needs of the treated rather than the treater.

4. *Factor D*

This factor at this pole describes a personality that is stodgy, placid, of phlegmatic temperament, and somewhat undermotivated. To those whose cognitive processes are unfettered by prescientific systems of dogma, and who know delinquents, this finding would be obvious and would constitute a confirmation of hypothesis. But such intellectual independence does not stand out as a predominant quality in this area of application, and the predominant view of the delinquent is one in which the delinquent is described by high excitability. Pierson and Kelly (16, 17) found a statewide population of delinquents to differ from normals on this factor at the .01 level. The present confidence level is .001. Thus we may state that D factor is found to distinguish delinquents from nondelinquents at the .0001 confidence level.

5. *Factor E*

This factor is clearly defined and easily recognized clinically. It may be described as a quality of obedient, mild, dependent submissiveness *versus* an assertive, aggressive, rebellious dominance. There are doubtless few who would be surprised that this group, selected for their aggressive delinquent potential, would score significantly above average on this personality dimension. It should be noted, however, that the statewide delinquent population mentioned above (16) did not differ significantly on E factor. This once again suggests what has been suspected earlier (14), that despite a core of personality source traits common to all delinquents there exists a yet undiscovered typology in delinquency that awaits application of the best multivariate methods. This problem has been looked at in premetric terms, but more precise methodology will be needed to sort out such types.

6. *Factor J*

This factor does not appear to have obvious clinical psychological meaning and has indeed been described by Professor Cattell (1, 2) as a difficult factor to interpret. It was earlier thought to be something of a "fussbudget" factor, and some of the descriptions of it brought to mind the image of the mildly eccentric professor shuffling papers in complete oblivion to the realities of his external environment. The time would appear due to restructure our thinking

about this factor. J factor continues to demonstrate its criterion validity in a number of studies and is here replicated as *the most influential source trait in delinquency*.

High J is described as individualistic, obstructive, reflective, coasthenia. From this one might speculate that the factor is a mere statistical artifact, devoid of psychological meaning. This view is hard to countenance in view of its demonstrated discriminatory power and its external criterion validity. In view of these facts we should perhaps view J factor as a challenge to our understanding of personality and its relationship to environmental situation. For, as the formula $R = f(S, P)$ —behavior is a function of the interaction of personality and situation—reminds us, this is the subject matter of psychology (7). At this point we must, however, as Thurstone admonished, bring to bear as many clinical intuitive impressions as we can to explain this finding.

Soon after the 1963 statewide study (16) we began looking at high J individuals and reached the impression that they are indeed individualistic, but in what we might in American vernacular refer to as "one way": that is, the environment is expected to give, never to receive, from the individual. The delinquent himself in Washington refers to such a person as "jappy," a term which to him carries much negative meaning. There is a definite risk in such interpretation that what we perceive in the individual as J factor may be contaminated by other factors, but there is no way clinically to partial out *in situ* the influences of other such dimensions.

This is, however, the idiographic approach in clinical psychology and, until something better can come along, will have to suffice as a method of individual assessment, which takes into account the idiographic uniqueness and nomothetic position of the individual within his demonstrably deviant group.

7. Factor Q_3

This factor is again found in the sample to be significantly below the population mean and ranks second in discriminatory power, when one considers that the confidence level of the replicated study is a function of the fiducial limits of studies 1 through N, thus $C = (F_1 F_N)$: i.e., $(F_1 = .01, F_N = .01, (F_1 F_N) = .0001)$. This factor appears to be pretty clearly the psychoanalytic construct of the ego ideal and is thus a substructure of the "larger" more influential superego construct, as conceptualized psychoanalytically.

G Factor within the present conceptional scheme is labeled the superego factor, and appears to be the "thou shalt not" component of character. We

have not dwelt at length upon the nonsignificant factors because of space limitations; but some discussion in this area appears warranted and necessary. For this purpose let us regard the influences of factors G (Superego) and Q₃ (Self Sentiment Integration) to be what psychoanalysis calls the superego. Let us avoid semantic entanglements, however, and use the popular term, "character," in place of superego. Viewed in this way, we immediately see that in the juvenile delinquent, in contrast to the psychopath (5, 6), only a part of the character is disordered. The delinquent knows the difference between "right and wrong" (G+), but he has failed in his development to internalize an integrated socialized value structure (Q₃+) upon which internal controls are built. Lacking such an internal model to guide his behavior, his behavior reflects his view that it is better to be bad than to be nobody.

8. *Individual Diagnosis*

Pierson and Kelly (16) offered the score DELST as a measure of delinquent potential. In a crude way DELST combined the discriminatory power of all significant factors into one score. This measure was offered as a tentative research tool, but to our knowledge it has not stimulated research into its use. The authors are prepared to offer a refinement in DELST which is in more refined terms quantitatively. Therefore:

$$\text{DELST} = \frac{\sum_1^k \frac{X_i t_k}{\sum_t}}$$

One simply sums the individual scores on the significant factors which have been weighted by their respective t values and divides by the sum of the t 's. The resulting score will be on a 10-point scale. Even relatively simple electronic data processing equipment could easily handle this equation; or, lacking that, tables could be worked out for all possible values of $X_i t_k$.

9. *Some Social Psychological Implications*

It is by now common knowledge that the character disorders far outweigh neurosis in terms of numbers and probably rank as the number one social problem in America today and, indeed, in many countries of Western culture [see Pierson *et al.* (19)]. These data would appear to confirm two observations that have occupied the attention of social scientists for several decades: (a) the decline in effectiveness of the father as a developmental model of identification for character growth and (b) the firmly entrenched and now popular idea

that permissiveness and material abundance are essential to normal personality growth.

Eysenck (9) expressed concern that psychoanalysis was eagerly and unquestioningly accepted by the laity and professionals alike. He argued cogently that this very mass acceptance of the theory belied its validity in terms of *its own* logical system. Be that as it may, the few untested hypotheses of Freud have filtered their way into popular literature; and, just as gossip becomes more distorted with each retelling, so the confused parent is taught by writers of popular magazines to raise his children in ways that are an affront to common intelligence. By all kinds of persistent social pressure he learns to do so with unquestioning faith.

There are few things more pathetic than to see in the clinic a man who knows he should have been a father but is loathe to explain why he was not.

The pendulum may swing back, but it is in danger of doing so in angry primitive frustration. The authors' concluding hope and recommendation is that the forces of social control will reappraise the findings of all relevant sciences; and, where gaps exist in our knowledge, will recommend parental instinct as a guide rather than witchcraft.

E. SUMMARY

The High School Personality Questionnaire (HSPQ), 1963 edition, was administered to 338 male juvenile delinquents. The results were compared to the general population. The results were discussed with reference to earlier HSPQ norms for the delinquent. A means of relating these nomothetic findings to the idiographic study of the individual was discussed. The diagnostic discriminatory powers of eight personality and character factors were replicated at levels of confidence in excess of .001.

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ACTION PATTERNS IN THE AGED*

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HOWARD FRIEDMAN

A. INTRODUCTION

Some initial attempts have been made to comprehend the functioning of the aged within the genetic conceptual framework elaborated by Werner (4). Thus, Rochwarg (3), using the Rorschach Test, observed that the perceptual functioning of senescent subjects was characterized by "... a reversal in the developmental pattern of perception away from the maximum hierarchic integration and organizing capacity characteristic of adulthood" (3, p. 62). Similarly, Friedman (2) found that memory functioning could be understood "in terms of reversal in the developmental memory pattern with concomitant re-emergence of genetically lower levels of organization" (2, p. 8). These studies suggest that (a) retrogression or involution, the obverse of development, characterizes normal senescent functioning; and (b) such regression can be understood, at least from a structural standpoint, within Werner's general developmental law.

The purpose of the present study is to determine whether these suggestive conclusions can be confirmed through investigation of another parameter of ego functioning in senescent subjects. In a previous study which related the action patterns of schizophrenic patients to Werner's genetic framework (1), tasks were devised that could be analyzed in terms of the syncretic and diffuse nature of primitive action. The current study investigates similarly the structural aspects of the action patterns of senescent subjects. The hypothesis is: healthy aged subjects will exhibit less differentiation and hierarchic integration in their action patterns than would a comparable group of young adult subjects.

B. SUBJECTS AND METHOD

Volunteers from local senior citizen clubs made up a pool of 23 physically healthy, active, aged subjects (A). A group of 22 young adult subjects (Y) was obtained from volunteer hospital employees and college students.

The experimental tasks employed to reflect primitive action patterns were

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three of the five described, with rationale, in the previous investigation of schizophrenic functioning (1). It was necessary to limit the number of experimental tasks, as well as those tests from which intellectual functioning was estimated, in order to avoid fatigue and boredom in the aged and to gain maximum cooperation. The selection of tasks was made on an *a priori* basis of those most appealing to adults.

The two tasks which had been devised to exemplify the diffuse character of primitive action were used: (a) HOUSE-HORSE and (b) paper mazes. The HOUSE-HORSE task, as previously described more fully, required subjects to light up five light bulbs, thus spelling the word HOUSE, by finding the appropriate toggle switch among several identical switches beneath each letter. After two consecutive errorless trials, the letter R was substituted for U, and the subject was instructed to light up the word HORSE. The score was the number of trials to light up HORSE without error. This task reflects the tendency to a rigid all-or-none reaction as a consequence of experiencing a homogeneous undifferentiated gestalt. Thus, a small change in the totality disturbs the global whole so that the entire course of action must be repeated anew. In the hopes of making the apparatus more discriminatory, a fourth row of toggle switches was added so that beneath each of the five letters there were now four switches, one of which lit up the letter in its column.

In the second task, paper mazes, global diffuseness is exemplified by responding to a new gestalt, which is actually a combination of two familiar ones, as though it were an undifferentiated unit rather than a synthesis of two units. Thus, each subject was required to do the left half of Maze 4 in the Revised Beta Examination, then the right half, and finally Maze 4 in its entirety.

The third task, using the circuitous-route apparatus, reflected the individual's ability to release himself from the domination of the concrete field and use devices of mediation between stimulus and response. This could then demonstrate developmentally higher order behavior, for such devices of mediation are not evident in primitive action. The subjects were required to roll a ball down a wooden alley in order to reach one of several shuttered openings arranged laterally at the end of the alley. The apparatus was so constructed that the first and second openings could be reached by direct straight line approach. The third opening was so placed that only banking the ball off one or more walls permitted success, although this was not obvious on inspection. The score was the number of trials for the third opening before the subject attempted to bank the ball.

With the exception of a few members of the A group who became unavail-

able for completing some test items, all subjects were administered the vocabulary, digit span, and digit symbol tests of the Wechsler Adult Intelligence Scale (WAIS). Thus, estimates of intellectual functioning based on a measure, vocabulary, least sensitive to aging could be obtained; and through the other tests, some further screening for undetected deficits in functioning attributable to possible intracranial organic pathology could be achieved.

C. RESULTS AND DISCUSSION

The differences between the groups on all the tasks were tested by the Mann-Whitney *U* test. Once learning to criterion was established on the HOUSE-HORSE apparatus, no significant differential change in task performance as a function of age was observed.

In view of the general motor slowness common to aging, the paper mazes difference score obtained was changed from subtracting the time for the third maze from the average of the times for the first two mazes, as in the previous

TABLE 1
SIGNIFICANCE OF DIFFERENCE BETWEEN GROUPS ON TASKS

Variable	Paper mazes		Circuitous route	
	Y	A	Y	A
<i>N</i>			15	12
Female	16	6	5	4
Male	6	3	18-29	62-82
Age range	18-29	64-82	1.0	5.0
Median	—3	—7.0		
<i>p</i>		.03		.01

study, to subtracting the third maze time from the sum of the first two mazes. Poorer performance would be reflected in larger negative scores. In comparing the A and Y groups, consideration also had to be given to equating performance times on the initial mazes. Thus, from the A pool it was possible to obtain a maximum of six female and three male subjects whose time scores on the initial maze were within the range of the Y group initial maze scores. The two groups did not differ significantly by *t*-test on any of the three WAIS age-scaled test scores. As can be seen in Table 1, the A subjects exhibited statistically significantly larger difference scores than did the Y subjects. These findings then suggest that the A group tended to respond in a more globally diffuse manner than did a comparable group of Y subjects.

On the circuitous-route apparatus, there were 20 subjects in the Y group and 16 in the A group after eliminating those subjects who did not complete all three WAIS tests or did not perform in accordance with experimental task

instructions. The ratio of male-female subjects in each group turned out to be identical. As Table 1 indicates, the A group takes significantly more trials than the Y group before engaging in circuitous action. The differences between the groups in digit span and digit symbol test scores were not significant, but the mean age-scaled score of 14.6 for the Y group was significantly greater by *t*-test than the A group mean score of 12.9. It is extremely unlikely, however, that the difference of 1.7 in vocabulary age-scaled scores could account for the observed difference in performance of the circuitous-route task, a difference that points to a greater immediacy of behavior in the A group than in the Y group.

It would appear, then, that the action patterns of the aged, as compared to young adults, can be characterized by a greater degree of global diffuseness and less use of the devices of mediation. These findings, reflecting a primitive quality, point to a lesser degree of differentiation and hierarchic integration. As such they are in support of the hypothesis that normal senescent functioning may be characterized by retrogression and that such regression can be comprehended from a structural standpoint within Werner's general developmental law.

D. SUMMARY

Previous studies suggested that normal senescent perceptual and memory functioning were characterized by a retrogression that could be comprehended within the genetic conceptual framework of Werner. The present study attempted to determine whether another aspect of ego functioning, action patterns, would be in support of the previous findings. The hypothesis was that healthy aged subjects would exhibit less differentiation and hierarchic integration in their action patterns than would a comparable group of young adult subjects. From a previous investigation of the structural aspects of action patterns in schizophrenia, three of five tasks devised to reflect various aspects of primitive action were selected. These tasks, together with the vocabulary, digit span, and digit symbol tests of the WAIS, were administered to a pool of 23 healthy, active, aged (A) subjects and a pool of 22 young adult (Y) subjects. With the paper mazes task, it was possible to obtain, on the basis of equivalent performance on initial mazes, six female and three male subjects, 64-82 years of age, from the A pool to compare with the 16 female and six male subjects, 18-29 years of age, from the Y pool. For the circuitous-route task it was possible to obtain 15 female and five male subjects, 18-29 years of age, from the Y pool, and 12 female and four male subjects, 62-82 years of age, who completed all WAIS subtests and the experimental task. Performance

on these two experimental tasks was significantly different in the two groups, with the A group responding in a more primitive fashion than the Y group: i.e., in a more globally diffuse manner and with greater immediacy of behavior. On the HOUSE-HORSE task, no significant differential change in task performance as a function of age was found. On the basis of the other two tasks, the results are considered as generally supporting the hypothesis of lesser differentiation and hierarchic integration in the structural aspects of action patterns of the aged, as compared with the young subjects. As such, the findings are consonant with the notion that retrogression characterizes normal senescent behavior, and that such regression can be comprehended within Werner's general developmental law.

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THE IMPACT OF EXPERIENCE WITH THE AGED UPON THE TIME PERSPECTIVE OF YOUNG ADULTS*¹

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A. INTRODUCTION

Two lines of research converge to suggest that young adults hold a prevaillingly negative attitude toward the later years of life. A number of attitudinal studies indicate that young adults tend to regard elderly adults as being rather different from themselves, with the differences usually having a negative affective tone (2, 11, 14). Investigations in the general realm of time perspective have contributed the additional finding that most young adults do not take the later years of their own lives very much into account. Furthermore, the valuable and satisfying achievements, events, and experiences are seen as being limited largely to the years of early or middle adulthood (3, 10).

These investigations seem to have made their points. But our knowledge of attitudes and perspectives on old age will remain quite incomplete until we understand how these viewpoints originate, and under what conditions they may be subject to modification. The present study, then, is one small attempt to learn something about the potential modifiability of viewpoints toward old age that are held by young adults. The study was conceived within the framework of the developmental-field theory of aging (6, 7, 8), but here attention will be limited chiefly to the empirical material. It may be sufficient to note that developmental-field theory emphasizes the patterns of interaction between the individual's relatively enduring situation. Time per-nizing experience, and the dynamics of his immediate situation. Time perspective² seems to offer a fruitful approach for studying the relatively enduring frameworks of organizing experience, and the concern for the immediate situation implies the desirability of experimental as contrasted with correla-

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² Reviews of the time perspective literature have been prepared by Fraisse (1), Kastenbaum (5), Wallace and Rabin (15), and Wohlford (16).

tional research designs. And so we have the present experimental approach which employs selected aspects of time perspective as the dependent variables, and a situational context as the independent variable.

The experimental problem was to determine whether or not a period of intensive experience with people of advanced age would lead to systematic changes in the time perspective of young adults. Previous research had led to the expectation that young adults, such as student nurses, would have a limited outlook on the later years of life (10). Might this outlook be expanded following intensive exposure to aged persons, and might the outlook change in qualitative as well as quantitative aspects?

B. METHOD

1. *Subjects*

Ss in the experimental group were 46 student nurses; the total sample was comprised of four consecutive subsamples. Mean age was 19.3 years. A control group of 46 student nurses was comparable in age with the experimental Ss (mean age: 19.8 years). All Ss in both groups were females. None of the Ss whose data are included here had substantial experience with elderly people prior to the study.

2. *Procedure*

The experimental Ss completed two time perspective measures before and after a six-week placement in Cushing Hospital, an all-geriatric institution operated by The Commonwealth of Massachusetts. The mean age of patients at this time was 82 years, more than four times as great as the mean age of the Ss. The control Ss were treated in the identical manner, except that their field placement was in a general neuropsychiatric hospital and involved little or no contact with elderly patients.

One of the instruments administered was the Age-Appropriate Attitudes Technique (AAAT), Part I: "Six Futures" (10). The AAAT presents a set of six brief character sketches (see Table 1). Each of the fictitious individuals described has a different outlook on futurity. The characters and their outlooks represented are Harry (The Null Future), Phil (The Uncertain Future), Charlie (The Exuberant Future), Grant (The Satiated Present), Ted (The Beloved Past), and Sam (The Despised Past). S's task consists of (a) estimating the most likely age of each character, (b) explaining the basis for his answer, and (c) reporting what S would say to each character after becoming familiar with his outlook. These judgments are made for each sketch as it is presented. At the conclusion of the set, S is requested to state

which of the characters has a point of view which is most similar to his own outlook.

The other instrument to be reported here is the Important Years (IY) technique (4). This procedure requests *S* to select from the total life-span (past, present, and future) the three years that he considers "most important."

TABLE 1
AGE-APPROPRIATE ATTITUDES TECHNIQUE, PART I: "SIX FUTURES"

Sketch	Outlook
<i>Harry</i> is feeling very blue. He has decided that the future holds nothing for him.	The Null Future
<i>Phil</i> wonders if he is really getting any place. He does not know whether he should be hopeful or pessimistic about his future.	The Uncertain Future
<i>Charlie</i> is feeling great. He feels his life is just beginning, that nothing can stop him.	The Exuberant Future
<i>Grant</i> feels that he has everything he wants. He is completely satisfied with his life, and desires nothing more.	The Satiated Present
<i>Ted</i> does not like new things. He prefers the old way of doing things, feeling that things are not as good as they used to be.	The Beloved Past
<i>Sam</i> has no use for the old way of doing things. He prefers everything new, believing that things are getting to be much better than they used to be.	The Despised Past

Respondents are encouraged to use their own life-spans as the frames of reference and to determine for themselves what constitutes a particularly "important year." *S* indicates his reason for each choice that he makes.

C. RESULTS

The possibility that personal time perspective might be expanded following extensive exposure to aged persons was studied chiefly with respect to five variables: (a) temporal range of thought, (b) future extension, (c) past extension, (d) relative age of identified characters, and (e) type of character with whom identification is made. Because the meaning of absolute scores on these dimensions has not yet been sufficiently clarified, nonparametric analyses of test-retest changes were made.

In the present study the *temporal range of thought* is defined operationally as the inclusive distance between the youngest and oldest important year selected by *S*. Thus, a *S* who selects year one (1 year of age) as his first IY (Important Year) and year 35 (35 years of age) as his last IY, has a temporal range of 35 years. It is important to note that he might have used an identical

range with different beginning and terminal points (e.g., $IY - 1 = 30$ years of age and $IY - 3 = 64$ years of age). This variable, then, is concerned only with the scope of the person's temporal conception apart from its absolute location within his total life-span.

Increase in temporal range of thought is defined as a positive change in this study. As can be seen in Table 2, positive changes occurred with a significantly greater frequency in the experimental than in the control group ($p < .001$).

TABLE 2
TEMPORAL RANGE OF THOUGHT: TEST-RETEST CHANGES

Group	N	Increase	No change	Decrease
Experimental	46	34	10	2
Control	46	13	22	11

Note: $\chi^2 = 18.78$, $df = 2$, $p > .001$.

Future extension is defined here as S 's projection into the future as it is relative to his own present chronological age. Thus, the last important year mentioned ($IY - 3$) stands at a certain temporal distance (or at 0 distance) from S 's present age. Temporal range of thought and future extension are complementary variables. The former provides an estimate of scope without mooring it to a definite section of the life-span, while the latter charts the absolute location. A person might, for example, have a large temporal scope, but all the inclusive years may be in his past; or, again, they may be all in the future; or he may locate himself (chronological age) at variable distances between $IY - 1$ and $IY - 3$.

Significantly more S s in the experimental group increased their future extension on retest as compared with the control group ($p < .001$). In a second and even simpler analysis, a significant increase was found in the number of experimental S s who mentioned at least one year that extended beyond their chronological age. Although the test-retest difference in the experimental group was significant at $p < .001$, it should be noted that the experimental and control groups differed under the baseline conditions at the .01 level. At the conclusion of the study there was no longer a significant difference between experimental and control groups: e.g., the experimental S s had made up their "deficit" (see Tables 3 and 4).

Past extension is defined here as projection into earlier chronological years relative to S 's present age, a parallel to future extension. More experimental than control S s changed in the direction of increased past extension, but this difference fell short of the minimally acceptable .05 level (Table 5). In a

2×3 chi square analysis, the difference is significant at .25. A simpler positive change *vs.* nonpositive change analysis (2×2 chi square) yielded a value significant at the .06 level. We do not consider that the present findings demonstrate a definite change in the direction of increased past extension for the experimental Ss, but the data do suggest that further research on this point might be fruitful.

TABLE 3
FUTURE EXTENSION: DIRECTION OF CHANGE

Group	N	Increase	No change	Decrease
Experimental	46	35	7	4
Control	46	15	21	10

Note: $\chi^2 = 17.57$, $df = 2$, $p < .001$.

TABLE 4
FUTURE EXTENSION: MENTION OF AT LEAST ONE FUTURE YEAR

Group	N	Condition	Yes	No	Vs. group	χ^2
Exper.	46	Test	24	22	Control: Test	6.90*
Exper.		Retest	43	3	Exper.: Test	19.82**
Control	46	Test	36	10	Control: Retest	2.76
Control		Retest	38	8	Exper.: Retest	2.58

* $p = .01$.

** $p = .001$.

TABLE 5
PAST EXTENSION

Group	N	Increase	No increase	No change	Decrease
<i>Direction of change^a</i>					
Experimental	46	22		18	6
Control	46	13		25	8
<i>Increase vs. no increase^b</i>					
Experimental	46	22	24		
Control	46	13	33		

^a $\chi^2 = 3.73$, $df = 2$, $p < .25$ n.s.

^b $\chi^2 = 3.74$, $df = 1$, $p > .06$ n.s.

The relative age of the AAAT characters with whom S identified provides another estimate of his future extension. As can be seen in Table 6, most Ss in both groups selected either Uncertain Phil or Cheerful Charlie. It is only with these Ss that the present analysis is concerned. Both groups on both test and retest estimated Charlie to be the youngest of the six AAAT characters, and Phil as second youngest. Changes in identification from Charlie to Phil were considered to be in the positive direction—i.e., from a younger to

a slightly older or more mature outlook—and shifts from Phil to Charlie were considered to be in the negative direction.

There were no “negative changes”—that is, movements from Uncertain Phil to Cheerful Charlie—in either group from test to retest. However, significantly more *Ss* who were exposed to aged people for six weeks, as compared to those unexposed, shifted their self-images from Charlie to Phil (Table 6). Movement from Charlie to Phil appears to be not only an increase in age-of-identified-character, but also in complexity (Table 7). Phil, with his alternate interpretations of the future, seems to be taking more contingencies into consideration, having abandoned a simpler and rosier outlook. This interpretation is supported to some extent by qualitative data from both procedures, particularly reasons for a particular year being considered important, and what one would say to each AAAT character. Experimental *Ss* anticipated a greater variety of experiences in the later years of life and had a greater variety of comments to make on retest than had been the case initially.

TABLE 6
SHIFTS FROM CHARLIE TO PHIL *vs.* NO SHIFTS

Group	<i>N</i> ^a	Charlie-Phil	Charlie-Charlie
Experimental	40	20	20
Control	38	4	34

Note: $\chi^2 = 14.24$, $df = 1$, $p < .001$.

^a Six experimental and eight control *Ss* made choices other than Charlie on pretest. There were no Phil-Charlie shifts in either sample.

TABLE 7
RANKS AND MEAN AGES ATTRIBUTED TO AAAT CHARACTERS

Character	Test		Retest	
	Rank	Mean age	Rank	Mean age
<i>Experimental group^a</i>				
Harry	5	36.5		
Phil	2	22.9	4	36.8
Charlie	1	20.3	2	24.3
Grant	4	36.0	1	21.0
Ted	6	53.8	5	42.9
Sam	3	28.6	6	61.7
			3	30.1
<i>Control group^b</i>				
Harry	3	29.1		
Phil	2	24.7	4	33.7
Charlie	1	21.1	2	24.7
Grant	5	44.0	1	22.2
Ted	6	64.6	5	44.8
Sam	4	31.9	6	64.8
			3	31.0

^a *N* = 46.

^b *N* = 46.

D. DISCUSSION

Cross-sectional studies have suggested that range of temporal thought increases with increasing chronological age from adolescence to adulthood. Future extension also increases on the specific dimensions described in this paper. Also, the dominant preference for identification with Cheerful Charlie tends to give way to a wider assortment of identifications as young people mature, with the specific shift to Phil being most common (10). These data have not yet been extended to the later years of life.

To the extent that our previous findings might be representative, it seems that "growing up" is accompanied in general by increased projection into the future and a more complex and individualized way of orienting oneself to the future (9). Viewed in these terms, it would appear that the student nurses in the experimental group were stimulated by their intensive experiences with elderly patients to re-examine their notions of what life held in store for them personally. This reorganization was in the direction of a larger, more complex, and more conflicted domain of psychological time. The pattern of results suggests that it was the increase in future extension that contributed most significantly to increased temporal range of thought and, in a sense, to what might possibly be described as a relatively more "mature" outlook.

While the decrease in identification with the yeasty, simple future optimism of Charlie was one of the more striking findings in the experimental group, attention should also be given to the lack of two-way traffic in both groups. That no young woman who has once identified with Uncertain Phil returns to Charlie implies that a developmental progression might be involved. This interpretation receives circumstantial support from previous research and the general developmental-field account of time perspective (9).

A number of further research tasks are suggested by the present study and are of particular relevance to developmental-field theory. One would like (a) to examine the behavioral concomitants of the shift in time perspective and how long both of these endure; (b) to examine possible changes in thought and behavior on the part of the elderly persons with whom the young people interact; (c) to identify the specific factors that are responsible for these changes, and (d) to focus upon brief, directly observed young-old interaction as, for example, in the first substantial conversation that a young person has with a nonagenarian.

One also wonders about the implications of age-segregated living arrangements when the present results are considered. Rosow (12, 13) has concluded, both from his own sociological studies and those of other investigators, that elderly people are quite unlikely to develop substantial interpersonal relation-

ships with younger people in our contemporary society. He believes that age-segregated housing is in the best interests of the elderly person, as it provides maximum opportunity to form peer relationships. However, the present study hints at the possibility that the younger person may be deprived of something rather important for his own development if he lacks the opportunity to interact substantially with a variety of representatives of senior generations. Perhaps young and old will not seek each other out under most of the prevailing social conditions, but, once they do become involved in the same situational context (as in a geriatric hospital), it appears that previous attitudes toward aging in general and one's own aging are apt to be modified.

E. SUMMARY

This investigation found that intimate contact with elderly people can stimulate at least a temporary reorganization of personal time perspective in younger people. Forty-six student nurses were tested before and after six weeks of intensive experience with geriatric patients; a control group of 46 student nurses training in a nongeriatric hospital was tested under similar conditions. Upon retest, the experimental group, as compared with the control group, showed significantly greater changes in personal life view as exemplified by increased range of temporal thought, increased future extension, and increased identification with older and more complex individuals.

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CONDITIONED ACTIVITY DEPRESSION IN HYPOTHYROID AND HYPERTHYROID RATS*¹

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A. INTRODUCTION

Studies of the effect of the thyroid gland on emotional behavior are relatively rare. This seems amazing in view of the extensive influence that this organ has on basic physiological processes (metabolism, neural sensitivity, heart and muscle function) and considering the clinical observations of mental symptoms connected with thyrotoxicosis, cretinism, and myxedema.

Reports from the clinic indicate that psychopathology is almost always characteristic of hypothyroidism in both its congenital (cretinism) and its adult (myxedema) forms. The symptoms connected with cretinism are primarily due to the retarded development of the nervous system. Irritability is a marked feature of myxedema, even though such individuals are generally apathetic and lethargic. Reaction time is slow and memory is impaired.

The clinical picture of hyperthyroidism is that of an overactive individual. The pulse is rapid, blood pressure is high, and muscles show tremor and weakness. Nervousness, emotional instability, and hypersensitivity are also present.

An extensive review of the relation of the thyroid gland to mental disease has been carried out by Gibson (6). Many attempts have been made to demonstrate that emotional stress leads to thyroid dysfunction, but it appears that these attempts have failed. One problem is that it is impossible to determine from clinical data whether stress situations are of etiologic importance, or whether they occurred during the course of thyroid disease and were accentuated by that disorder. There is much more support for the contention that stress has an enhanced effect in individuals who already have thyroid disease or that long continued or repeated stress may bring on thyrotoxicosis in a predisposed subject (6). Emergency situations which are overcome by

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normal individuals often will produce a mental breakdown in endocrine patients (13).

This brief consideration of the clinical literature leads to the conclusion that the thyroid gland definitely does influence emotional behavior in humans, often to an extreme degree. However, the details of this relationship remain unspecified.

Research using animal subjects appears to support the existence of an effect of the thyroid on emotional behavior, but again this effect has not been well defined. Korn (7) demonstrated that the startle response was larger in hyperthyroid rats than in hypothyroid or control animals, with no significant differences being observed between these latter two groups. Feuer and Broadhurst (4) found that rats given propylthiouracil (an antithyroid drug) showed an increase in defecation scores in an open field situation, but did not obtain significant effects with the injection of thyroid hormone. Hyperthyroid animals (fed dessicated thyroid) performed better than controls on a shuttle avoidance task, while hypothyroid rats (fed thiouracil) were worse (14). Whittaker (19) measured the effect of various dosages of thyroxine on the learning of a head-movement response to avoid shock to the tail in rats. Although small doses appeared to facilitate conditioning, large doses were detrimental.

B. PROBLEM

The literature just reviewed suggested the hypothesis that was tested by the experiment to be reported: namely, that the response to stress is influenced by the functional state of the thyroid gland. There is much indirect support for this hypothesis, but as yet there has been little research that bears directly on this problem.

The response to stress which was studied in this experiment was a depression in exploratory activity following a brief experience with electric shock. The procedure is similar to that used in Hall's open field test of emotionality, except that the Ss are placed in a rectangular runway rather than in a large square field. In pilot work in this laboratory, it was observed that rats which were placed in this runway 24 hours after being shocked in a grill box exhibited depressed activity when compared to nonshocked rats. Similar results have been reported by Baron (1) and by Campbell and Candland (3).

It has also been demonstrated in this laboratory, and by Campbell and Candland, that this activity depression is a response that is conditioned to the handling that precedes the shock stress. When Ss are placed in grill boxes, but are not shocked for at least 40 minutes, they show no significant differences in activity from nonshocked Ss. Thus, when handling is followed by

shock within a few seconds, a conditioned fear response is acquired to handling as the conditioned stimulus (CS). After 24 hours, the animal is handled again when it is placed in the runway, and this handling elicits the fear response, including freezing, which leads to activity depression.

Although the primary purpose of the following experiment was to determine whether the thyroid gland has any effect on a conditioned response to stress, it was also designed to provide further information on the relationship between thyroid function and activity. The evidence seems clear that thyroidectomy leads to a decrease in activity (15, 16). There is also some evidence, although not a great deal, that antithyroid drugs, such as thiouracil (11), also depress activity in rats and that methylthiouracil does so in dogs (8). Injections of thyroid hormone do not appear to have a great effect, if any, on activity. Thyroxine has been shown to increase the "motor activity" of dogs (8) and to increase ambulation in rats "in the majority of cases" (4). However, Mann (10) was unable to observe differences in revolving wheel activity between rats fed thyroid extract and the same animals with a normal diet.

In the following experiment, effects on activity are studied using a different antithyroid drug and a different form of thyroid hormone from those used previously. The hormone that was used, triiodothyronine, was selected because certain tests have found it to be over seven times as active as thyroxine, and the latent period required for it to produce its effect is less than with thyroxine [see Turner (18, p. 114)]. Although it is not certain which of these two forms acts on the peripheral tissues or whether a combination is essential, a strong case has been made for triiodothyronine as the natural and rapid acting hormone (9). There are no behavioral studies in which triiodothyronine has been used to produce hyperthyroidism. The relative potency of triiodothyronine, and the possibility that it is the principal form of thyroid hormone, suggested that it might produce an effect on activity that has not been observed previously with thyroxine.

C. METHOD

1. *Subjects*

The Ss in this study were 108 male albino rats, born and raised in the Carnegie Tech colony. They were 55 to 65 days old when placed in single cages at the start of the experiment.

2. *Apparatus*

The runway was 42 inches long, 8 inches wide, and 6 inches high, and was made of $\frac{3}{4}$ -inch boards. It had a clear $\frac{1}{8}$ -inch Plexiglas hinged ceiling which

could be secured by catches at either end. A floor was provided by placing the runway on a white Formica table top. The apparatus was lighted by two $7\frac{1}{2}$ -watt bulbs 28 inches above the floor and $10\frac{1}{2}$ inches from either end of the runway. All wooden parts of the apparatus were painted light gray. The inside wall of the runway which faced *E* was divided into 10 sections by $\frac{1}{8}$ -inch lines. The two end sections were 5 inches long and the eight center sections were 4 inches long.

Shock was administered by an Applegate stimulator Model 228 through brass rods spaced $\frac{1}{2}$ -inch on center which formed the floor of a grill box $10 \times 12 \times 8\frac{1}{2}$ inches. Shock duration was controlled by a Hunter decade interval timer, Model 111-B. The walls and hinged roof of the grill box were made of wood and were painted gray except for the front wall, which was made of Plexiglas covered with construction paper to diffuse entering light.

Heart rate (HR) was recorded on a Gilson M5P polygraph. The electrode used in recording HR was a horseshoe-shaped harness which was placed over the rat's back and secured by a rubber band under *S*'s stomach.² Two dimes on the inside of the harness made contact with the sides of *S* and conductivity was improved by placing electrode paste on the dimes and on the sides of the rat where its hair had been shaved. The recording lead wire was then plugged into a socket on the top of the harness.

3. *Thyroid Manipulation*

In order to create hyperthyroidism, triiodothyronine (Cytomel)³ was prepared in a solution for injection. This involved dissolving the triiodothyronine in .01N sodium hydroxide solution, adding water for injection, USP, up to 50 per cent of final volume, adding and dissolving sodium chloride, and then making up to final volume with water for injection. The strength of the solution was 400 mcg per cc.

The antithyroid drug, methimazole (Tapazole),⁴ was used for creating hypothyroidism. This drug is readily soluble in water and was mixed with .9 per cent saline solution to produce 50 mg per cc.

Changes in HR were used as the criterion of the effectiveness of the thyroid treatments. Several studies argue in favor of a direct effect of the thyroid on the heart beyond the change required by adjustment of cardiac output to altered metabolic rate [see Rawson and Sonenberg (12, p. 955)]. Triiodothyronine

² This electrode was developed by S. Millard at the University of Pittsburgh School of Medicine, Department of Clinical Science.

³ Cytomel was supplied through the courtesy of Mrs. L. S. Jaffe and Dr. J. H. Birnie of Smith Kline and French Laboratories.

⁴ Tapazole was obtained through Dr. J. M. McGuire of Eli Lilly and Company.

has been shown to increase HR in rats (5) and antithyroid drugs to decrease HR (11).

4. Procedure

At the start of the experiment, *Ss* were taken from the group cages where they had lived since weaning and were placed in single cages where they remained undisturbed for two days. During the morning of the third day the *Ss* were handled for the first time for about two minutes. On the following day, *E* began to shave the sides of the *Ss* in preparation for HR measurement. Each *S* was removed from its home cage and taken to another room where electric clippers were used to do the shaving, after which *S* was returned to its home cage after a total of two to three minutes of handling time. This procedure was repeated on the next two mornings (Days 5-6).

On the afternoon of the sixth day, the first runway test and the first HR measurement were carried out. The *S* was carried to the testing room in its measurement were carried out. The *S* was carried to the testing room in its home cage, which was placed on a table next to the table supporting the runway. A blower in the testing room provided a masking noise, while the only illumination came from the two bulbs on the runway. The *S* was picked up by the tail and was placed in the left end of the runway (the end closest to *S*'s cage), facing the end wall. A stopwatch held by *E* was started as soon as the ceiling of the runway was closed. A remote switch which activated counters in the next room was held by *E* and was used to record the number of lines passed by *S*. An *S* was said to have passed a line when its hindquarters (i.e., the beginning of its tail) passed the line. Separate remote switches were used to record activity during the first two minutes and second two minutes of the four-minute period that *S* was in the runway. At the end of the test, *S* was removed from the runway and returned to its home cage which was placed on a table outside the test room, while *E* recorded the activity score and the number of boluses produced by *S* while in the runway. After *E* wiped the table with a damp cloth, *S* was returned to the colony room.

At this time all *Ss* that gave a total score of less than 10 were dropped from the experiment. Out of the 124 *Ss* originally scheduled for this experiment, 16 had to be dropped for failing to meet the criterion. Also, in an attempt to reduce variability by equating the groups for initial activity levels, *Ss* were assigned to one of the eight experimental groups on the basis of their responses on this first test. These eight groups formed a factorial design with four levels of thyroid function (hyperthyroid, hypothyroid, saline control, handling control) and two levels of stress (shock and no shock). Sixteen *Ss* were assigned to each group so that the means and the variances of the group scores on the initial test were approximately equal.

An initial HR measurement was taken on each *S* after testing in the runway had been completed for all *Ss*. Two different rooms were used for runway testing and for HR measurement; the heart rate room had normal lighting and no masking noise. The *S* was carried to the heart rate room in its home cage and was then removed from its cage and held by *E*, while the harness electrode was put on and the lead plugged in. Heart rate was recorded for 100-150 seconds, while *S* was moving about freely. After measurement was concluded, *S* was wiped off with a paper towel, and was then returned to its home cage and to the colony room.

During the morning of each of the next five days, *Ss* were weighed and injected or handled. The hypothyroid group was injected intraperitoneally with methimazole, 15 mg per 100 g; hyperthyroids received triiodothyronine, 60 mcg per 100 g; saline controls received .30 cc per 100 g; and the uninjected controls received an amount of handling equivalent to that received by the injected groups. Since hair began to grow back on the sides of the *Ss*, they were all shaved again on the morning of the fourth injection day in preparation for the final HR measurement.

On the afternoon of the fourth day of injections, a second HR measurement was taken on all *Ss* approximately four hours following their injections using the procedure described above. Immediately after its HR had been taken, each *S* was carried to the runway test room in its home cage where it was placed in the grill box and either given five shocks at 2.5 ma at one second intervals, or else allowed to explore the grill box for six seconds, depending on whether it had been assigned to the stress or no stress condition. The grill box was located on the table next to the runway and the illumination and noise conditions in the room were the same as those present during the runway test. The home cage was placed next to the grill box, *S* was picked up by the tail and placed in the grill box for treatment, and was then replaced in its home cage and returned to the colony room.

On the next day, injections were given in the morning as usual, and four hours later the *Ss* received a final test in the runway using the same procedure as in the initial test. Injections and treatments were timed so that this final test occurred 24 hours after the treatment of the previous day.

D. RESULTS

1. Heart Rate

The effectiveness of the thyroid treatments was defined in terms of changes in HR. The initial and final mean HRs of the stress and control groups for each injection condition are presented in Table 1. The HR for an individual

S was determined by taking five readings from its polygraph record at approximately 20-second intervals and then computing the mean of these five readings. Analysis of variance showed significant effects of Thyroid Treatment ($F = 39.85$, $df = 3/104$, $p < .001$), Initial *vs.* Final Test ($F = 34.01$, $df = 1/104$, $p < .001$), and the interaction of these two factors ($F = 151.74$, $df = 3/104$, $p < .001$). Individual *t*-tests were carried out comparing the initial and final means for each thyroid treatment, combining the stress and no stress conditions. A significant increase ($t = 41.23$, $df = 104$, $p < .001$) was found for the triiodothyronine group, while significant decreases were observed for the methimazole ($t = 15.91$, $df = 104$, $p < .001$) and the uninjected controls ($t = 2.14$, $df = 104$, $p < .05$). However, this latter decrease was not a typical effect, since 11 out of 28 *Ss* showed an increase in HR, whereas for the methimazole *Ss* there was only one increase. None of the triiodothyronine-injected *Ss* showed a decrease in HR. Therefore, it was concluded that the thyroid treatments were effective.

TABLE 1
MEAN HEART RATES (BEATS PER MINUTE) ON THE INITIAL (I)
AND FINAL (F) RUNWAY TESTS

Injection condition	Stress		Control	
	I	F	I	F
Methimazole	474	438	478	434
Triiodothyronine	478	585	479	579
Saline	473	471	472	474
Uninjected	480	473	476	472

2. Body Weight

Analysis of variance of weights on each of the five injection days indicated significant effects of Days ($F = 14.21$, $df = 4/416$, $p < .001$) and the Thyroid Treatment \times Days interaction ($F = 30.02$, $df = 12/416$, $p < .001$). There were no significant differences as a function of stress. The saline and handled control groups exhibited a mean gain of about 18 grams over the five-day period, while hyper- and hypothyroid groups showed a mean loss of about eight grams.

3. Conditioned Activity Depression

The mean activity scores (number of lines crossed) during the two-minute periods of the initial and final runway tests are presented in Table 2. Analysis of variance revealed no significant differences between groups in runway activity on the initial test, showing the effectiveness of the matching proce-

ture. However, there was a significant Periods effect ($F = 5.22$, $df = 1/104$, $p < .001$), supporting the hypothesis that activity was greater during the second two minutes than during the first two minutes of the test. None of the interactions was significant.

On the final runway test, the effects of Thyroid Treatment ($F = 3.17$, $df = 3/104$, $p < .05$) and of Stress Condition ($F = 43.47$, $df = 1/104$, $p < .001$) were found to be significant by analysis of variance, while the null

TABLE 2
MEAN ACTIVITY DURING FIRST AND SECOND TWO-MINUTE PERIODS
OF INITIAL AND FINAL RUNWAY TESTS

Injection condition	Stress		No stress	
	1st	2nd	1st	2nd
<i>Initial (matching) test</i>				
Methimazole	36.86	38.64	37.64	41.14
Triiodothyronine	40.79	37.36	38.50	40.86
Saline	37.71	41.50	32.07	44.93
Uninjected	35.00	40.00	36.07	44.29
<i>Final test</i>				
Methimazole	11.57	6.00	30.07	20.43
Triiodothyronine	18.43	18.50	35.36	36.43
Saline	20.00	16.43	40.21	35.57
Uninjected	13.36	16.71	37.36	36.43

hypothesis could not be rejected for the effect of Periods and for the interactions.

Individual t -tests were carried out on comparisons of the four thyroid treatment groups with the data pooled across Stress Conditions and Periods. It was found that the methimazole Ss differed significantly from the triiodothyronine group ($t = 1.78$, $df = 104$, $p < .05$) and from the saline group ($t = 1.93$, $df = 104$, $p < .05$), but not from the uninjected control Ss. All other comparisons resulted in t 's of less than 1.00.

4. Bolus Count

The mean number of boluses produced during the initial and final runway tests is presented in Table 3 for each of the groups. It can be seen that Ss in the saline and uninjected control groups that received stress show the largest increases in defecation from the first to the second test, while those control Ss that were not stressed show the largest decreases. The direction of these changes is the same for the hyperthyroid (triiodothyronine) groups, although the magnitude of the changes is much smaller. On the other hand, hypothyroid

(methimazole) Ss that have been stressed show a decrease in defecation, whereas the nonstressed group shows a slight increase. The extremely variable and skewed nature of these data argued against the use of parametric statistical tests. Also, the relatively large initial differences in defecation would have made it difficult to interpret any between-groups comparisons. Therefore, only the changes in number of boluses produced from the initial to the final test were evaluated by means of the nonparametric Wilcoxon matched-pairs signed-

TABLE 3
MEAN NUMBER OF BOLUSES PRODUCED DURING THE INITIAL (I)
AND FINAL (F) RUNWAY TESTS

Injection condition	Stress		No stress	
	I	F	I	F
Methimazole	4.9	3.9	2.9	3.1
Triiodothyronine	4.1	4.3	3.0	2.4
Saline	3.0	4.3	5.0	4.3
Uninjected	3.1	4.7	3.8	2.6

ranks test (17). Of the changes referred to above, only the increase for the uninjected-stress group and the decrease for the uninjected-no stress group were significant at the 5 per cent level of confidence.

E. DISCUSSION

The conclusion that the response to stress, as indicated by conditioned activity depression, is not affected by the thyroid gland is supported by the absence of a significant interaction between thyroid treatments and stress conditions. Hypothyroid, hyperthyroid, and normal rats which have received acute electric shock stress all exhibit proportionally the same lower activity compared to nonstressed controls. The effectiveness of the thyroid manipulation was indicated by the significant changes in heart rate.

There are many parameters that could be manipulated in an attempt to obtain a differential response to stress in this situation. Perhaps shocks of a lower intensity would not have affected normal rats but would depress hyper- or hypothyroid animals. Then again, the drug and hormone dosages may be a significant factor. Brody (2) and Whittaker (19) found that small doses of thyroxine facilitated conditioning, while large doses were detrimental. If such a curvilinear relationship holds for triiodothyronine, then the dose used in this experiment may have had an intermediate effect.

The other measure taken in the runway, the bolus count, did provide some indication of a differential response to stress. Defecation has been widely used

as a measure of "emotionality" and may also be referred to as overcompensation of the parasympathetic nervous system following an intense sympathetic response. The control animals in the present study showed an increase in defecation between the initial and final runway tests if they were stressed and a decrease in defecation if not stressed. These changes, however, were statistically significant only for the uninjected control groups, not the saline controls. On the other hand, the hyperthyroid Ss showed smaller changes in the same direction, while nonsignificant changes in amount of defecation were in the opposite direction for hypothyroid rats: i.e., decrease for stressed Ss and increase for nonstressed Ss.

The control group changes show that the runway test provided a valid measure of the response of the autonomic nervous system to the conditioned stimulus of handling. Pairing this CS with electric shock stress in the grill box led to an increase in the parasympathetic response elicited in the runway (greater "emotionality") when the CS was presented again immediately before the runway test. When handling was not followed by a noxious stimulus in the grill box, its occurrence 24 hours later before the runway test led to a decreased parasympathetic response.

At the present time it is not feasible to offer an explanation of the bolus data for the hypo- and hyperthyroid groups, since the effect of the thyroid treatments on general eliminative function was not determined. One of the symptoms of hypothyroidism in humans is constipation, while diarrhea is characteristic of hyperthyroids [see Rawson and Sonenberg (12, p. 957)]. Such information is not available for rats, but the possibility of an effect of the thyroid on defecation should not be overlooked and was not controlled in the present study. In order to do this, one would have to measure the amount, and perhaps the quality, of defecation in the home cage.

Although activity *per se* was not greatly affected by the thyroid treatments, it seems reasonable to conclude that rats made hypothyroid by methimazole injections were less active than hyperthyroid or normal animals. This conclusion must be considered as tentative, since the hypothyroids did not differ significantly from the uninjected controls. However, this finding is consistent with experiments in which activity was lowered as a result of injecting two other antithyroid drugs, thiouracil (11) and propylthiouracil (4).

On the other hand, it seems that hyperthyroid rats are not hyperactive. The literature contains no reports of significant increases in the activity of rats resulting from the administration of thyroid hormone in any form, except when given as replacement therapy to thyroidectomized animals. It hardly can be claimed, however, that this problem has received adequate investigation. As

with most areas of research on the relation of the thyroid gland to behavior, the number of studies is far too small to lend strong support to any general conclusions.

F. SUMMARY

Rats were made hypothyroid by injecting methimazole or hyperthyroid by injecting triiodothyronine. Control animals were either injected with saline or merely handled. Half of the animals in each of these groups were given electric shock stress, while the others were placed in the grill box but not shocked. All Ss were tested 24 hours later in a runway, where measures of activity and defecation were taken. It was found that: (a) stressed animals exhibited lower activity than do nonstressed animals, regardless of thyroid condition; (b) hypothyroid rats were less active than hyperthyroids or injected control animals; and (c) in the control groups, but not in the thyroid-manipulated groups, stress led to increased defecation, whereas handling led to decreased defecation.

It was concluded that, under the conditions of this experiment, the conditioned response to stress was not affected by the functional state of the thyroid gland.

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BEHAVIOR CHANGE IN A THERAPEUTIC SUMMER CAMP: A FOLLOW-UP STUDY*

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In recent years a number of summer camping programs have been developed specifically for the troubled child. For example, the Michigan Fresh Air Camp which began as a camp for underprivileged children in 1921 has more recently evolved (1961) as an effective program for the diagnosis and treatment of emotionally disturbed boys (2). Myers (3) has prepared a report of the proceedings of two camping workshops which brought together directors of camps for emotionally disturbed children from several states. Summary statements are presented on numerous topics, including staff training, selection of campers, program planning, and the value of the camp setting itself as being intrinsically therapeutic. The workshop report emphasized the therapeutic advantages of summer camping. An entire issue of the *Journal of Social Issues* has been devoted to a discussion of therapeutic camping (1). Authorities in the field attest to the effectiveness of therapeutic camping, but stress the need for continued research and exploration.

Located in northeastern Alabama is a specialized summer camping program for emotionally troubled boys. During the 1963 camping season, the initial year of operation, 11 boys were accepted for the two-month session. The boys ranged in age from 8 to 14 and were average to superior in intelligence. Most of the campers exhibited difficulties in their interpersonal relationships and in their school work. The camp was directed by two clinical psychologists aided by consultants in psychiatry, social work, speech therapy, and psychology. A favorable camper to counselor ratio of three to one was maintained.

Each boy received considerable individual and group psychotherapy, but, more importantly, he was treated as an individual toward whom the entire staff directed common attitudes and behavior. For example, staff decisions were made as to what classes of behaviors would be rewarded and what limits would be imposed for each child. A full schedule of activities was maintained, and each boy was expected to take part in work assignments as well as play activities. Attempts to control and shape behavior took three major forms: (a) stage setting for the emergence of adaptive behavior, within the advantages

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of the camp environment; (b) social reinforcement of adaptive patterns; and (c) various forms of psychotherapy. Counseling sessions were held with the parents, and follow-up reports were sent to referring agencies in an effort to promote the transfer of adaptive camp behavior to the home environment.

During the 1963 season the impression was gained that the majority of the campers had shown improvement in their social relations and had emerged from the camping experience better able to accept limits and to function in a group. A follow-up questionnaire was sent to the parents three months after the camp closed to obtain their appraisal of the camping program. The following instructions were typed on the questionnaire: "Please circle the rating in each category which best describes your son's behavior now compared to his precamp behavior. Please make your choices as objectively and sincerely as possible. Please make comments where you feel they would be helpful."

Table 1 presents the parents' responses to the questionnaires. In terms of overall behavior with family members, 10 campers were reported improved or much improved and one was reported as unchanged. In overall behavior with peers, nine campers were reported improved or much improved and two were reported unchanged. Eight campers were reported to have improved in the quality of their work, while three remained unchanged. Question 4 indicated that all of the parents believed their child gained to some extent from his experiences at camp. If they had it to do over again, nine of the parents would have sent their child to the camp: two other parents might have sent their child. Eight couples believed that they profited from counseling with the directors, while three couples felt they gained very little or not at all. Parent responses to an additional question, "What did you like best about Camp Ponderosa?" were quite consistent. Seventeen comments centered around what the parents considered to be favorable attitudes and activities on the part of the staff. On the other hand, the parents were very inconsistent in replying to the question, "What did you like least about Camp Ponderosa?" Comments to this question appeared to reflect personal tastes, and no common thread was discernible.

The entire population of the questionnaires was returned. The results of the follow-up study, while encouraging, are obviously difficult to evaluate. A good measure of rapport had been established between the parents and the directors, and the parents may have been reluctant to express negative results. The categories to be rated were gross and in some cases presented problems in rating. In addition, a control group was not available. On the other hand, the questionnaires have served as a sort of standardized subjective parental report. It is concluded, with caution, that the majority of the parents were

TABLE 1
PARENTS' RESPONSES TO FOLLOW-UP QUESTIONNAIRE
(*N* = 11)

Question	Category	Response
1. Overall behavior with family members	Much improved	3
	Improved	7
	Unchanged	1
	Worse	
	Much worse	
2. Overall behavior with peers	Much improved	2
	Improved	7
	Unchanged	2
	Worse	
	Much worse	
3. Quality of school work	Much improved	1
	Improved	7
	Unchanged	3
	Worse	
	Much worse	
4. Did your child profit from his experience at Camp Ponderosa?	Very much	4
	Much	5
	Some ^a	2
	Little	
	Very little	
	None	
5. Knowing what I know now about Camp Ponderosa I _____ sent my child	Would have	9
	Probably would have	
	Might have	2
	Probably would not have	
	Would not have	
6. Did you as parents profit from counseling with the directors?	Very much	1
	Much	6
	Little	
	Very little	2
	None	1

^a Two respondents added the category "Some" when rating Question 4. pleased with the program and that they perceived their sons as having made progress associated with the summer camping experience.

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EVALUATION OF A PROGRAM FOR PROJECT HEAD START*

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A. INTRODUCTION

The Economic Opportunity Act of 1964 provided for the establishment of Project Head Start in communities that requested this activity and met the specified requirements of the Office of Economic Opportunity. Project Head Start was designed to assist culturally deprived children to bridge the gap between their experiences and those of their peers from culturally more affluent circumstances. The length of the program was eight weeks.

As an arbitrary operational definition of cultural deprivation, a child being socialized in a family whose cash income is less than \$3000 per year is categorized as belonging to a poverty strata of society. This definition is, of course, extremely loose and arbitrary, since the sum of \$3000 in cash is meaningless unless the specific environmental conditions and other means of income are taken into consideration. The size of the family, the scope of the family's interests, and the cultural milieu are all important in assessing the cultural standards, and in turn the degree of the cultural level and any deprivation of the individual from this standard.

For the United States as a whole, the culturally deprived child is one who comes from a family of four whose income is equal to or less than \$3000 *per annum*. It is this criterion which was used in selecting 85 per cent of the total student population of Project Head Start in Edgecombe County and the cities of Tarboro and Rocky Mount, North Carolina.

As pointed out in "*The child who is culturally deprived*,"² cultural deprivation may affect children in different ways. It is impossible to generalize dogmatically symptoms that can be ascribed to cultural deprivation. Certain trends have, however, been noted. While generally within the range of the more affluent children, the culturally deprived child will tend to be a little less well developed in his physical condition. Defects in speech, hearing,

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² Mimeographed material, distributed by North Carolina State University, unsigned, 1965.

vision, tonsils, and adenoids are more frequent than in the general population. Malnutrition is also prevalent. Lower vitality than in the usual child is to be expected due to a great number of minor troubles, such as a series of minor infections, excessive worry, and fatigue. This type of child may be somewhat more impulsive than other children. His attention span is shorter and more narrow than in other populations. The higher mental processes are definitely subnormal in identifying a problem, in reasoning, and in abstract ideas.

It is in intellectual traits, of course, especially the higher mental processes, that culturally deprived children are most conspicuously different from the average. In such simple matters as visual and auditory perceptions they are not markedly different. The amount of difference increases, however, as one considers the culturally deprived's performance in such matters as defining, distinguishing and analyzing. It is particularly in the complex mental operations of reasoning that the culturally deprived child falls short. This is, of course, to be expected, for reasoning is in essence the exercise of intelligence . . . the marshalling of intellectual powers and resources in dealing with a problematical situation. Reasoning involves the recognition of identification of the problem to be solved or the situation to be reasoned about, the formulation of possible solutions of courses of action that offer promise of fulfilling the requirements of the situation, and the testing of these possible solutions against remembered experience. It requires clarification, revision, rejection, or selection as fit the requirements. All this must be carried out in the imagination . . . the workshop of the mind . . . without so much as overtly batting an eye. It is quite clear why the culturally deprived child is a poor reasoner. It is poor reasoning that makes him slow.

The culturally deprived pupil learns in the same way, fundamentally, that other pupils learn. That is, he learns from experience. He initiates, he proposes and plans, he thinks and reasons, he experiments, he generalizes, and he draws upon his past experience or "transfers" it to meet new situations. But he does not think and reason as well; he is less imaginative, less able to foresee, and is inclined to jump at conclusions without adequately considering alternatives and without the benefit of much reflection. He is more likely to act upon impulse and to accept a fairly workable solution or approximate results than to exercise caution in advance or to be severely critical of the adequacy of his behavior for the situation in hand. At the same time, he is often more insistent on knowing what the purpose of an activity is or where it is leading if it is an activity suggested or required by someone else.³

It has been observed that he is insecure in relying upon his own judgments and in drawing final conclusions, which results in his hesitation to form any kind of answer without the approval of an adult.

³ "The child who is culturally deprived," p. 2.

With this description as part of the broad understanding of the problems of the underprivileged child and the specific conditions found to exist by Boone, King, Massey, and Seidel (1) in Nash and Edgecombe counties in Eastern North Carolina, the Nash-Edgecombe Economic Development, Inc. (NEED) developed as its goal for Project Head Start "Philosophy and objectives of Project Head Start" (3). Pertinent to the type of program developed are the following excerpts:

The most important item on the agenda of this summer readiness project is helping the pupil gain the background of experience which he needs to make reading, writing, and arithmetic meaningful and interesting when he/she enrolls in the regular session. Everything which the child sees, hears, and feels must be interpreted in terms of his own experiences. The more pleasure the child gets out of school, the better he gets along with other children. The more opportunities he has to talk and to make things with his hands, the more easily he will learn to read and write (3, p. 2).

The specific objectives of the project as related to pupils' participation are as follows:

1. To extend and enrich the general experiences of the pupil.
2. To broaden and improve pupil interest in reading, writing, and arithmetic.

3. To foster the personal-social adjustment of the pupil.

Improved and organized methods of providing pre-school experiences for pupils will enhance pupil attainment in school.

An effective summer pre-school readiness program can bring about increased school readiness on the part of the pupils for participation in school.

Changes in the pre-school learning environment will be accomplished by changes in pupils, parents, teachers, and administration.

1. Develop increased understanding of the nature of school readiness.
2. Gain insight into the meaning and value of the school readiness program.
3. Become more conscious of individual differences and their implications for teaching and learning (3, p. 3).

B. THE PROBLEM

In order to evaluate the success of the Project Head Start, a series of four tests was selected to be administered to a randomly selected sample of children in Project Head Start, stratified by race according to actual enrollment in the cities of Rocky Mount and Tarboro, North Carolina. These tests were administered to the sample during the first or second week of the project and again during the seventh or eighth week of the project in order to compare the results. The original design of the study called for a control group of an equal

number of subjects comparable in age, race, and economic status. It was found, however, that the response to the project was so great that plans for a control group had to be discarded.

The following tests were selected after pretesting:

1. The Lee-Clark Reading Readiness Test (6) was selected to serve as a standardized test to evaluate the effectiveness of the program in preparing the child to start reading, writing, and to comprehend appropriate basic mathematical concepts.

2. The Raven's Coloured Progressive Matrices (8) was selected primarily because of the abstractness of the designs of the test and the fact that it included color, form, and design, which are in general use in the broad culture. Moreover, Green and Ewert (4) state that the test involves fairly complex intellectual reasoning powers.

Harris (5) tested with the Raven's on 45 boys and 53 girls aged 5-1 to 6-1. These subjects were selected from an urban population in the United States by parental occupation. For this purpose the Minnesota Scale for Parental Occupations was used. The Raven was individually administered over a period of one month and the findings showed that there was no difference between the sexes. Harris also found that for 5 and 6 year olds, average and below in ability, the test proved to be difficult.

3. The Chicago Non-Verbal Examination (2), Parts 2, 3, 4, 5, and 8, was selected although it badly needs revision, modernization, and improvement of the format; other parts of this test were found unsuited to this population on pretests. It relies heavily on recognition of various aspects of the broad American culture.

4. A Teacher Appraisal Form, devised by the senior investigator, is attached as Appendix A.

C. PROCEDURE FOR DEVELOPING THE STUDY

1. *Subjects*

In the summer of 1965, forty counties in North Carolina participated in the Head Start Program which prepared 17,000 children for the first grade. Out of this total 1109 children were enrolled in the counties of Nash and Edgecombe area, constituting the largest enrollment in the state; Edgecombe county, 657; Rocky Mount, 287; Tarboro, 170. The proportion of Negro to white was approximately 4 to 1. There was a total composite of 69 teachers, 87 aides, 180 volunteers, 20 child development centers, and 69 classes. There were only four withdrawals.

In the Edgecombe county area 613 Negro children and 44 white children

enrolled. This was an increase of the original enrollment. Personnel consisted of 30 Negro and 10 white teachers, 32 Negro and eight white aides, and 54 Negro and 22 white volunteers. In the city of Rocky Mount the total pupil enrollment of Negroes was 228, and for whites it was 54. This was also an increase of the original enrollment. Total composite of personnel was 14 Negro and four white volunteers. In Tarboro 139 Negro children and 31 white children enrolled, which was an increase of the original plan. Tarboro employed six Negro and five white teachers and aides, and 31 Negroes and 26 whites volunteered their services.

This study was only concerned with the cities of Rocky Mount and Tarboro and Princeville combined. All references to Tarboro in this paper include the combined Tarboro and Princeville Project. In Rocky Mount, six city schools were used.

TABLE 1
ORIGINAL ENROLLMENT IN HEAD START AND SAMPLE OF STUDY IN TWO CITIES

Schools	Initial enrollment	Number used in study
<i>Rocky Mount</i>		
Battle	18	5
Bassett	29	8
Baskerville	65	14
Holland	35	12
Lincoln	40	12
Pope	58	14
Total	245	65
<i>Tarboro-Princeville</i>		
Bridges	15	5
North Tarboro	15	5
Patillo	80	30
Princeville	30	10
Total	140	50

Table 1 shows the initial enrollment of children in Head Start and the sample that participated in the study in the cities of Rocky Mount and Tarboro-Princeville.

A stratified random sample was used to select the samples from Rocky Mount and Tarboro. Sampling ratio to population of children originally enrolled in Head Start was proportioned to keep the ratio of the sample to the population constant. Within Rocky Mount, 65 preschool children were selected from the initial Head Start population of 245. Six schools were used in the program. The ratio between whites and Negroes in the original population was computed to be 1 to 4.

From the cities of Tarboro and Princeville combined, 140 preschool chil-

dren were scheduled to participate in Head Start. Out of this total, 37 Negro and 13 white children were picked randomly as a sample. Of this number, a ratio of 1 to 3 between whites and Negroes was computed.

The ratio between the Head Start population in Rocky Mount and in the cities of Tarboro and Princeville combined was determined to be 1.75 to 1. This constituted a total sample of 115; 50 preschool children from the combined cities of Tarboro and Princeville and 65 from Rocky Mount. Although the initial enrollment in these cities increased, the sample determined from the original population was not changed.

After the number of the sample was determined by proportioning the sample to each school enrollment, the subjects were randomly selected by taking every third name on the school roster.

2. *Design of the Study*

The study was designed to assess the change made between a first testing and a retest. In order to measure the change between the first test and the retest, which were about a month apart, a *t*-test (9, pp. 167-171) was used. To determine if there were any significant differences between the two cities—Rocky Mount and Tarboro-Princeville—on the first testing and the retesting periods, an *F*-test (9, pp. 175-201) was used primarily because of the radical difference in the size of the two samples. The Duncan Range (7, pp. 172-187) was applied to the Rocky Mount and Tarboro samples separately to test for significance of difference between the various schools on all four tests used in the study. Correlations (9, pp. 141-146) were run in Rocky Mount and Tarboro between each test to determine the relationship between the factors being tested.

D. FINDINGS AND RESULTS

The Duncan Range Test was used to test the significance of difference between means of scores of all schools in Rocky Mount and in Tarboro-Princeville during the first week and eighth week of the Head Start program.

Table 2 shows that there was no significant difference between the mean of the scores on all four tests of the six schools in Rocky Mount on the first and second testing. A similar result was found by applying the Duncan Range to mean scores of all four schools in Tarboro-Princeville. This finding would indicate that there was no significant difference in performance on these four tests between the four schools participating in the Head Start Project in Tarboro-Princeville.

TABLE 2
DUNCAN RANGE TEST MEANS SCORES ON TESTS WITHIN EACH CITY

DUNCAN RANGE TEST MEANS SCORES ON TESTS WITHIN EACH CLASS								
Test	No. groups		Rp ^a		MD ^b			
	1st	2nd	1st	2nd	1st	2nd	1st	2nd
<i>Rocky Mount</i>								
Raven								
Chicago	6	6	9.38	14.78	4.51	8.15	n.s.	n.s.
Lee-Clark	6	6	27.80	32.89	16.00	13.90	n.s.	n.s.
Teacher-Appraisal	6	6	36.72	30.09	17.35	15.04	n.s.	n.s.
	6	6	20.15	16.68	8.11	61.52	n.s.	n.s.
<i>Tarboro-Princeville</i>								
Raven								
Chicago	4	4	8.36	14.03	5.50	5.10	n.s.	n.s.
Lee-Clark	4	4	19.04	21.15	10.54	15.65	n.s.	n.s.
Teacher-Appraisal	4	4	25.82	20.86	21.90	18.81	n.s.	n.s.
	4	4	10.91	10.38	3.92	5.04	n.s.	n.s.

Note: No significant difference was found on either the first or eighth week of testing on any test in either city.

^a "Least significance ranges."

^b Difference between extreme means of the six groups.

TABLE 3
MEAN SCORES ON FIRST AND SECOND TESTING IN TWO CITIES

School	Raven's		Chicago		Lee-Clark		Teacher appraisal	
	1st	2nd	1st	2nd	1st	2nd	1st	2nd
<i>Rocky Mount</i>								
Holland	13.25	13.09	18.25	15.63	26.25	46.82	21.60	30.20
Battle	12.25	14.00	22.40	25.40	43.60	50.20	26.80	29.80
Bassett	16.71	20.33	16.00	21.50	43.42	48.16	25.40	27.57
Baskerville	12.71	12.18	25.00	16.75	36.07	43.36	29.71	30.57
Lincoln	13.08	13.08	9.00	11.50	28.66	35.16	26.91	27.33
Pope	12.50	14.28	12.40	16.64	34.10	45.28	26.00	33.85
Total mean	13.24	14.00	16.79	16.66	33.79	43.93	26.59	29.74
<i>Tarboro-Princeville</i>								
Bridges	14.75	12.75	19.50	7.75	34.50	44.00	20.50	23.00
Patillo	14.18	12.69	8.50	11.84	25.06	35.19	23.12	28.04
North Tarboro	14.60	12.40	12.60	23.40	22.20	42.20	19.20	23.00
Princeville	19.60	17.50	14.50	18.40	31.50	38.80	22.20	27.10
Total mean	15.45	16.09	11.48	14.22	26.95	37.55	22.24	26.77

TABLE 4
F TEST COMPUTED TO COMPARE ROCKY MOUNT SAMPLE WITH TARBORO SAMPLE

Test	Mean		Rocky Mount		F		p	
	Tarboro							
	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Chicago	11.48	14.22	16.48	16.50	7.17	3.31	<.01	n.s.
Lee-Clark	26.96	37.55	33.81	43.93	11.70	12.60	<.01	<.01
Raven	15.46	16.09	13.27	14.02	12.01	6.83	<.01	<.05

Table 3 shows the mean scores on all tests on the first and second administrations in Rocky Mount and Tarboro-Princeville.

An F test was used to compare mean scores on each of the three standardized tests between the samples in Rocky Mount and Tarboro. Table 4 shows the results on the first testing and the second testing.

The F tests performed showed the following results:

The sample in Rocky Mount performed on the Chicago Non-Verbal Examination significantly better ($p < .01$) than did the Tarboro sample. On the second testing there was no significant difference between the two samples.

TABLE 5
CORRELATIONS (r) BETWEEN VARIOUS TESTS ADMINISTERED ON FIRST TESTING TWO CITIES

Test	r	p	
<i>Rocky Mount^a</i>			
Chicago <i>vs.</i> Raven	.211	n.s.	
Lee-Clark <i>vs.</i> Chicago	.584	<.01	
Lee-Clark <i>vs.</i> Raven	.606	<.01	
Raven <i>vs.</i> Teacher appraisal	-.214	n.s.	
Chicago <i>vs.</i> Teacher appraisal	.537	<.01	
Lee-Clark <i>vs.</i> Teacher appraisal	.362	<.01	
<i>Tarboro^b</i>			
Chicago <i>vs.</i> Raven	.309	<.05	<.01
Lee-Clark <i>vs.</i> Chicago	.779	<.01	
Lee-Clark <i>vs.</i> Raven	.515	<.01	
Raven <i>vs.</i> Teacher appraisal	.155	n.s.	
Chicago <i>vs.</i> Teacher appraisal	.046	n.s.	
Lee-Clark <i>vs.</i> Teacher appraisal	.389	<.05	<.01

^a $N = 64$, $df = 62$.

^b $N = 46$, $df = 44$.

The results of the Lee-Clark Reading Readiness Test showed the more urban Rocky Mount sample to be significantly better in performance ($p < .01$) on both test administrations than the Tarboro sample.

For some reason not clear to the investigators, the Tarboro sample performed at a significantly higher level proficiency on the Raven Progressive Matrices Test on both test administrations than did the sample from Rocky Mount. On the first testing $p < .01$ and on the second testing $p < .05$.

Correlations were computed using the Pearson Product Moment formula (9) between the various test results in Tarboro and in Rocky Mount at the time of the first testing only. The correlations between the various tests in Tarboro and Rocky Mount are in many cases comparable, but are diverse enough to preclude any general statements. More study is needed.

Table 5 shows the correlations in Rocky Mount and the correlations in Tarboro.

Table 6 shows that significant improvement differences in test scores were obtained in the Head Start program, at the 1 per cent level of confidence in Rocky Mount and Tarboro schools on the Lee-Clark Reading Readiness Test, and all phases of the Teacher Appraisal. No significant change was made on either the Raven's or Chicago test. It should be noted that no attempt was made to measure *IQ* on either the Raven's or Chicago tests. The Teacher Appraisal was designed to elicit a numerical evaluation score on questions

TABLE 6
t-TEST COMPARING SCORES ON EIGHTH WEEK WITH SCORES OF FIRST WEEK: TWO CITIES

Test	<i>t</i>	<i>p</i>	
<i>Rocky Mount</i>			
Raven	1.50	.14	n.s.
Chicago	1.35	.18	n.s.
Lee-Clark	8.79	<.01	
Teacher appraisal			
Total	3.49	<.01	
Adjustment	2.69	<.01	
Motivation	3.38	<.01	
General	7.64	<.01	
<i>Tarboro</i>			
Raven	.47	.64	n.s.
Chicago	1.28	.20	n.s.
Lee-Clark	9.01	<.01	
Teacher appraisal			
Total	5.48	<.01	<.01
Adjustment	1.98	>.05	
Motivation	7.01	<.01	
General	3.90	<.01	

concerned with the child's adjustment, his motivations to learn, and the teacher's general appraisal of his readiness to learn. Further comments concerning these results will be made in the following section.

E. CONCLUSIONS AND DISCUSSION

According to the data obtained in this study, the Head Start Program in Rocky Mount and Tarboro was generally successful. The Duncan Range Test, which assessed the comparability of the students of the six schools in Rocky Mount and the four schools in Tarboro, showed that the school populations were homogeneous within each municipality. A further indication of the homogeneity of the schools in each municipality was shown by the nonsignificance of difference between the schools in the final week of testing. This would indicate that progress was uniform within limits in each municipality. Children were found to improve significantly in their readiness for reading

as measured by the Lee-Clark Reading Readiness Test. This test appears to be an instrument that measures the change over a period as short as eight weeks, such as this study covered.

The Chicago Non-Verbal Examination, which needs revision at present to modernize its content, although standardized on the age group relevant to this project, should be administered to very small groups by experienced testers. In this study, preliminary training was given to administrators. The lack of significance of change as shown by the nonsignificant *t*-tests may possibly reflect a de-emphasis on cultural phenomena in the program and a strong emphasis on preparation for reading readiness. Another possible explanation of this finding is that the test is more appropriate for older age groups than for younger age groups in that the concepts dealt with may be too complicated for the young groups. This possibility was fully anticipated before the test was selected, but it was thought that the project might bring about a significant change.

The Raven Coloured Progressive Matrices also did not show a significant difference between the beginning and end of the project in either Tarboro or Rocky Mount. The same hypotheses offered in explanation for the lack of significant change for the Chicago Non-Verbal may be proposed in this case.

The children who served as subjects were evaluated by the teachers as having made significant improvement in their motivations to learn, their general readiness for school work, adjustment to other children, to the school situation, and to the teacher. The Teacher Appraisal Inventory, although not standardized and in need of considerable refinement, shows promise as an evaluation instrument for a Head Start Project.

In both cases the testing conditions may not have been favorable for good results, since children from a culturally deprived population may have some difficulty in relating to the test administrator. It was also noted by the testers that the Lee-Clark Reading Readiness Test, because its format is more simple than that of the Chicago Non-Verbal, was able to hold the attention and interest of the subjects for a greater length of time. One seasoned tester suggested that the "cluttered" appearance of the Chicago test caused confusion which detracted from the interest of the testees. One other observation from test administrators was that the standardized method of administering the Lee-Clark Reading Readiness Test afforded an opportunity for increased attention to the testee by the tester and that this may have encouraged the testee to perform at a higher level.

While it is felt that a definite improvement was obtained in certain traits measured, such as recognition, identification, attention span, similarities and

differences and general comprehension, the factor of normal maturation could have been better controlled if a control group had been available.

F. SUMMARY

This research was an attempt to evaluate a Head Start Program conducted in the cities of Rocky Mount and Tarboro, North Carolina, in the summer of 1965.

Four tests, the Raven Coloured Progressive Matrices; the Chicago Non-Verbal Examination, Parts 2, 3, 4, 5, and 8; the Lee-Clark Reading Readiness Test, Kindergarten and Grade 1; and the Teacher Appraisal Inventory developed by the senior investigator, were administered to a stratified random sample of children chosen from the total population. These tests were administered during the first and eighth weeks of the program.

Analysis of the data showed that there was a significant difference ($p < .01$) between the first and second administration of the Reading Readiness Test and the Teacher Appraisal Inventory in both cities. Administration of the Duncan Range test showed no significant difference between the schools within each city at the two test administrations.

The Chicago Non-Verbal Examination tended toward significance as did the Raven Coloured Progressive Matrices. It is felt that if the Chicago Non-Verbal Examination were modernized it would be useful in this type of investigation.

This study showed that Project Head Start achieved its major goals in the cities of Rocky Mount and Tarboro.

APPENDIX A

MEMORANDUM TO TEACHERS IN TARBORO AND ROCKY MOUNT SCHOOLS IN HEAD START PROGRAM

We are presenting a series of interview questions which deal with the various aspects of the development of the children who have been selected to make up the random sample for our evaluation of the Head Start Program. A list of those children in this sample will be supplied to you. We are not so much interested in your evaluation of the individual child but rather his standing in relation to the whole group.

In the last week of the program, we will ask you to fill out a similar form. All information will be anonymous and confidential.

Please attempt to answer this second form as you see the child during the last two weeks of the program. *Compare each child with children who have previously entered the first grade.*

On the right side of the interview form you will notice a column for making a numerical entry. Your evaluation for each question should be as follows:

<i>Rating</i>	<i>Numerical Value</i>
Superior	4
Excellent	3
Good	2
Poor	1
Not Observed	0

IN GIVING YOUR NUMERICAL EVALUATION, PLEASE CONSIDER ONLY THE BEHAVIOR OF THE CHILD AS OBSERVED BY YOU, DO NOT TAKE INTO CONSIDERATION ANY REASONS YOU MIGHT CONSIDER TO BE CAUSES OF THE BEHAVIOR.

REMEMBER, YOU ARE ASKED TO COMPARE EACH CHILD IN THIS STUDY WITH CHILDREN WHO HAVE PREVIOUSLY ENTERED THE FIRST GRADE.

THE COMMENTS IN PARENTHESIS ARE FOR YOUR GUIDANCE AND MAY HELP TO CLARIFY THE INFORMATION DESIRED. DO NOT HESITATE TO USE OTHER CRITERIA WHICH WOULD BE SUITABLE.

A. Adjustment

Rate

1. How well has the child adjusted to being in school? (Away from home, among strange people, etc.)
2. How well has the child adjusted to other students? (Plays well, withdraws, shies away, acts in arrogant or obnoxious manner.)
3. How well does the child participate in organized activities? (Plays well, prefers solitary play, disrupts, shares well, comfortable in his role.)
4. How well does the child relate to the teacher? (Seeks excessive attention, is affectionate, afraid, indifferent, arrogant, comfortable.)
5. How well is he able to entertain himself or occupy himself alone? (This does not mean withdrawal behavior, but refers to the ability to use constructively his time as appropriate for his age.)

B. Motivation: Interest in the School Program

6. How much interest does he show in new experiences? (Enthusiastic and eager to find new ways of doing things, is apathetic, interested in new people.)
7. Evaluate the child's general enthusiasm for the school program. (Likes school very much, is apathetic, shows enthusiasm for some parts, dislikes program, not enthusiastic.)
8. How enthusiastic is he for learning? (Evidences by question, bringing in prized possessions, attention to others' experience, desire to read or to write, talk, about bringing siblings, etc.)
9. Desire to maintain self in clean, presentable manner. (Is clean, feels inferior due to poor apparel, accepts poor attire but talks of future hopes.)

10. How strong has he shown curiosity in the broader culture in the U.S., to which he has not been exposed? (Mountains, hills, T.V., radio, trains, buses, telephones, different foods, civil authority, movies, aircraft, jets, astronauts, ships, foreign countries.)
11. On field trips, how curious is he about new experiences? (Does he evidence interest, talk about what he has seen and learned, state ambition, want repeat trips, express desire for further trips?)
12. How would you place this child in general readiness in relation to the children you have taught in the past? (This refers to the first two weeks.)

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INTERPERSONAL AND OBJECTIVE DECENTERING AS A FUNCTION OF AGE AND SOCIAL CLASS* ¹

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A. INTRODUCTION

The general purpose of the present study was first to investigate the relation between interpersonal decentering and objective decentering, and second to investigate decentering activity as a function of age and social class.

In attempting to clarify cognitive processes, both Piaget and Werner (14, 17) have viewed them as a means of gaining information about the environment and oneself in relation to the environment. Piaget distinguished between perceptual and conceptual processes as the major determinants of cognitive activity. Genetically earlier perceptual processes are called "sensory-motor intelligence," which can be defined as operational or classes of operations that deal with concrete entities. Bruner (2) referred to operations at this stage as "iconic thinking," since thought processes are always mediated by concrete objects. Conceptual thought or reflective intelligence, as Piaget defines it, differs from sensory-motor intelligence in that it is not bound to "concrete entities" or "perceptual givens," but has the characteristic of infinitely expanding spatio-temporal distances between subject and object. Bruner referred to thinking at this stage of development as "symbolic" as opposed to "iconic" because it can be carried out without the necessity of concrete objects. Piaget views mature cognitive functioning as a predominance of conceptual processes over perceptual processes. Harvey, Hunt, and Schroder (10) hold a position similar to that of Piaget who viewed personality development in terms of increasing conceptual level. According to Witkin, Dyk, Paterson, Goodenough, and Karp (18), both Piaget's "sensory-motor intelligence" and lower conceptual level (10) would be considered as "field dependent" behavior, while conceptual thought or higher conceptual level would be considered "field independent" behavior. Thus, "cognitive processes" are viewed as reflecting greater

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maturity to the degree that internalized abstract schemes gain ascendancy over immediate sense impressions and percepts in the structuring of the organism-environment relationships.

Piaget has further pointed out that a dominance of "conceptual thought" is concomitant with the ability to "refocus" (decenter) from one aspect of a situation to another in a flexible, balanced manner. Piaget (16) sees this "decentering" or "refocusing" activity as a necessary prerequisite to the solving of their now famous conservation problems. Piaget and Inhelder (15) furthermore note that this decentration enables the child to visualize alternative spatial positions: e.g., imagining how a *papier mache* mountain might look to another person from positions different from their own. Their experiments indicate that, with increasing chronological age, children show an increasing ability to visualize alternative spatial positions (i.e., objective decentering increases with age).

Feffer (5, 6) has extended the concept of decentering activity to an analysis of the cognitive structuring of social content as revealed in role taking activity. The Role Taking Task (RTT) was specifically designed by Feffer to relate "decentering" activity to the interpersonal domain. Feffer and Gourevitch (7) have correlated two forms of cognitive decentering. Children of various chronological ages were given a series of objective cognitive tasks developed by Piaget and his co-workers, and a projective RTT. Performance on both Piaget's tasks and the RTT was analyzed in terms of the concept of "balanced decentering." The results indicated that older children show a greater degree of "balanced decentering" than do younger children in their structuring of objective cognitive tasks as in their interpersonal role taking behavior.

J. McV. Hunt (12) in discussing Piaget notes that the rate of development is in substantial part, but certainly not wholly, a function of environmental circumstances. Change in environment is required to force the accommodative modifying of schemata that constitute development. Thus, the greater the variety of situations to which the child must accommodate his behavioral structures, the more differentiated and mobile the structures become. Therefore, if environmental stimulation or deprivation affects conceptual structure, one variable that might enhance or detract from ongoing development could be the socioeconomic class of the child. Deutsch (3) notes that the emphasis on the importance of variety in the environment implies the detrimental effects of lack of variety. Restriction in variety, which is associated with low socioeconomic environments, might lead to systematic ordering of stimulation sequences, and would thereby be less useful to the growth and activation of

cognitive potential. Knupfer (13) also notes that low social status produces a form of mental isolation which operates to limit the sources of information, to retard the development of efficiency in judgment and reasoning abilities, and to confine attention to the more trivial interests in life.

Deutsch (3) points out that depressed environmental circumstances or experiential poverty may operate to curtail the child's conceptual development. Piaget emphasizes that more mature levels of conceptual development are built on the early and orderly progression through a series of developmental stages involving the active interaction between the child and his environment. Thus, the child from an economic and culturally deprived environment may progress through these stages at a lower rate as compared to children who do not undergo this form of deprivation. It might be expected that the child from the culturally deprived environment would therefore show proportionately more "perceptual" (i.e., sensory-motor) thinking over conceptual or abstract thought when compared to children who are not economically or culturally deprived. Bernstein [see Deutsch (3)], for example, found that lower-class children tend to convey concrete needs and immediate consequences in their verbalization, while middle-class children tend to verbalize more formally and emphasize the relating of concepts. Gollin (9), in a study of impression formation, found that lower-class children were less inferential and less conceptual in forming impressions, when compared with middle-class children.

Following from the theoretical and empirical discussion thus far, the present investigation was designed to study the interrelationship of two cognitive factors—interpersonal and objective decentering—and their relation to social class and age through testing the following hypotheses:

Hypothesis 1: Decentering scores on both objective and interpersonal tasks will increase with age.

Hypothesis 2: Decentering scores on both objective and interpersonal tasks will be higher in the middle-class group than in the lower-class group.

Hypothesis 3: Objective decentering will be positively related to interpersonal decentering.

B. METHOD

1. Subjects

The subjects (Ss) were 90 boys, forty-five considered lower class (LC) because the school is situated in a "center city" culturally deprived predominantly Negro section of the city, and forty-five considered middle class (MC) from a suburban parochial school. In each school an equal number of boys, 15, at each of three ages—7, 9, and 11—were seen.

Intelligence scores were based on the California Test of Mental Maturity. In an attempt to make the two groups from each school as comparable as possible on intelligence, *S*s in the lower-class group were from the upper part of the *IQ* distribution. However, the middle-class group was still the higher in *IQ*. Mean *IQ*s of the lower class were 95, 101, 106, at 7, 9, and 11 years, respectively, while the mean *IQ*s for the middle class were 110, 111, 119, at 7, 9, and 11 years, respectively.

2. *Objective Decentering Task: Piaget Perspective Task (PPT)*

a. *Procedure for PPT.* A modification of the task used by Piaget (15) was developed for measuring objective decentering which will be referred to as the Piaget Perspective Task (PPT). The test consisted of an asbestos model one meter square to 30 centimeters high representing three mountains. From the *S*'s position on one side of the model, the child sees a green mountain with a blue lake at the bottom occupying the foreground to his right. To his left the *S* sees a brown mountain, higher than the green mountain and slightly to its rear. This mountain is also distinguished from the others by a blue stream which runs from the top of the mountain down to the bottom one, the side facing the green mountain. In the background stands the highest of the three mountains, a green pyramid whose peak is covered with snow. A dark path runs down the left side of the mountain when the *S* is situated at the initial vantage point.

S was shown three miniature plaster models with the same characteristics of the large model, but which were approximately one-eighth of the size of the large model. These models can be arranged by the *S* to represent the mountains as seen from a given perspective.

Finally, the apparatus included a cardboard cutout of a man painting, and the *S* was told to imagine that the man was painting the mountain. *S*'s task was to imagine and reconstruct, by the process of inference, the changes in perspective that accompany the man's movements. With this purpose in mind, the child is given the three miniature models and asked to construct the kind of "picture" which could be painted of the mountains from his own position and then from the other three positions which are not readily open to his perspective. *S* performs these tasks at each of the four positions, or 16 reconstructions. Since *S*'s reconstruction from his own point of reference is pure repetition, scoring was on the basis of the other three points of perspective which are not immediately open to *S*'s perception. Thus, scoring was based on only 12 reconstructions.

b. *Scoring for PPT.* The scoring of PPT was designed by the present

author to obtain a quantitative index of objective decentering ability. For each response the *S* receives a score ranging from 0 to 6. There are seven types of responses of increasing order of magnitude indicating "decentering" ability. The procedure was designed so that responses could be scored immediately.

(1). *Score 0*. The child is unable to distinguish at all between his own viewpoint and that of the other perspective. In this situation the child makes no attempt to manipulate the miniature models (MM).

(2). *Score 1*. (a) Each time the cardboard man is moved the child makes a new manipulation of the three MM as if to produce the observer's point of view. (b) The manipulation ends up in the same positions that the *S* is perceiving from his own perspective. This type of response is considered more advanced than 0, since the *S* makes an attempt to free himself from his own perspective.

(3). *Score 2*. (a) Each time the doll is moved the child makes a new manipulation of the MM as if to produce the observer's point of view. (b) The manipulation produces an incorrect perspective concerning position left to right, but nevertheless is different from his own perspective. (c) The manipulation produces an incorrect perspective concerning depth position, but nevertheless is different from his own perspective.

(4). *Score 3*. (a) Each time the cardboard man is moved, *S* makes a new manipulation of the MM, as if to produce the observer's point of view. (b) Two types of responses are acceptable under Score 3: The manipulation produces a correct perspective concerning position left to right with an incorrect perspective in depth position, and the manipulation produces a correct perspective concerning depth position with an incorrect perspective in left to right position.

(5). *Score 4*. (a) Each time the doll is moved the child makes a new manipulation of the MM as if to produce the observer's point of view. (b) The manipulation produces a correct perspective concerning position left to right. (c) The manipulation produces a correct perspective concerning depth position. (d) Any one of all three of the mountains is inverted. This minor fault occurs, for example, when the lake at the base of the green mountain is not correctly placed in relation to the observer, even though the mountain is in the correct position.

(6). *Score 5*. (a) Each time the doll is moved the child makes a new manipulation of the MM as if to produce the observer's point of view. (b) The manipulation produces a correct perspective concerning position left to right. (c) The manipulation produces a correct perspective concerning depth

position. (d) The manipulation of the mountains produces no incorrect inversions as in (d) of Score 4.

(7). *Score 6.* This is an overall qualitative score. It is the same as Score 5 except that the child consistently makes correct responses from all perspectives.

In considering the above mentioned criteria, the reader should note that the child's manipulation of his own perspective, when the cardboard man is placed in his own viewpoint, is not scored. The hypothetical range of PPT scores is from 0 to 66. It was hoped that this scoring would be somewhat comparable to the already available scoring for interpersonal decentering described in the next section.

3. *Role Taking Test (RTT)*

Interpersonal decentering was measured by the Role Taking Test (RTT) devised by Feffer (5). The RTT is a projective task based on Schneidman's Make a Picture Story (MAPS). The test material for the MAPS consists of a series of background scenes picturing various locales and a variety of figures of men, women, children, and animals which may be placed upon these scenes. In the present study the background scene was a living room, which contained three figures: a happy man with gifts coming in the doorway, a young woman with an apron on, and a little girl with a ribbon in her hair who seems to be disappointed about something.

S is asked to tell a story concerning the three figures in the scene. After completing his story, *S* is again presented with the background. To dispel the impression that the *S*'s memory is being tested, *E* reads his story back to him and then asks *S* to retell his story as it would be seen from the point of view of each of the actors: i.e., to take the role of each of the three actors. The instructions are as follows: "Now make believe that you are the Father in the story you made up, and that you are telling one of your friends at work what happened to you when you arrived home last evening. Tell the story again as if you are the Father." Similar sets of instructions are given concerning the mother and daughter roles.

The concept of decentering (Piaget), or refocusing, which underlies the RTT suggests that an actor as an item of social content may be described from more than one point of view. The different roles represent different points of view, and the actor is the object upon which refocusing takes place from these points of view. Thus, the RTT is aimed at assessing how a subject refocuses upon a single item (actor), while assuming different points of view (roles). In this study the interrater reliability was .91 following the RTT

scoring procedure, quoted elsewhere in Feffer and Schnell's unpublished scoring manual (8) with the Feffer *et al.* (7) modification for children. The range of scores is from 0 to 17, which indicates quantitatively how well an *S* is able to maintain consistency within the story in the process of telling it from different points of view.

TABLE 1
MEAN AND STANDARD DEVIATION OF THE PIAGET PERSPECTIVE TASK SCORES AT
DIFFERENT LEVELS OF AGE AND SOCIAL CLASSES

Class	Age						Mean & standard deviation	
	7		9		11			
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
Middle	21.4	8.8	37.0	9.5	54.0	8.0	37.4	15.9
Lower	16.9	4.0	29.9	9.3	42.7	16.9	29.8	14.3
Mean & standard deviation	19.2	7.1	34.1	9.8	48.2	12.3		

TABLE 2
MEAN AND STANDARD DEVIATION OF THE ROLE TAKING TEST SCORES AT
DIFFERENT LEVELS OF AGE AND SOCIAL CLASSES

Class	Age						Mean & standard deviation	
	7		9		11			
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
Middle	4.0	1.5	5.6	2.2	9.7	5.5	6.4	4.2
Lower	2.4	2.0	4.8	3.3	6.9	3.8	4.7	3.6
Mean & standard deviation	3.2	1.9	5.2	2.7	8.3	4.8		

C. RESULTS

The mean scores of the two decentering tasks (PPT and RTT) are presented in Tables 1 and 2, respectively. These results will be considered in relation to the age and social class hypothesis.

1. Decentering as a Function of Age

The relationship between age and decentering activity is presented in Tables 1 and 2. Analysis of variance based on Table 1 revealed significant differences between age with regard to the PPT performance ($F = 7.3$ for 2 and 84 *df*, $p < .01$). Table 1 also indicates that combining MC and LC children did not distort the age trends, since both class groups showed an orderly increase of PPT scores with increasing age. It should be noted that

the standard deviations on the PPT increased with age. A Hartley test for equality of variance revealed significant differences between them at the three age levels. Although the assumption of equality of variance required for the F test was violated, the test was run in spite of this, since Box (1) points out that the F test is robust (i.e., insensitive to the violation of the assumption of equality of variance) when there are equal numbers of S s in each group tested.

Analysis of variance based on Table 2 revealed significant differences between ages with regard to the RTT performance ($F = 18$ for 2 and 84 df , $p < .01$). Table 2 also indicates that combining MC and LC children did not distort the age trends, since both class groups showed orderly age increases. Therefore, Hypothesis 1 is supported for both objective and interpersonal decentering.

2. *Decentering as a Function of Social Class*

Analysis of variance based on Table 1 revealed significant differences between MC and LC children with regard to the PPT performance ($F = 14.2$ for 1 and 84 df , $p < .01$). Analysis of variance based on Table 2 revealed significant differences between MC and LC children with regard to the RTT performance ($F = 8.12$ for 1 and 84 df , $p < .01$). Therefore, Hypothesis 2 was supported for both objective and interpersonal decentering.

3. *Decentering Between the Two Forms of Decentering*

Hypothesis 3 was tested within each of the three age levels and the correlations between the two decentering tasks were .26, .03, and .41 at the 7, 9, and 11 year groups, respectively.

A Fisher's exact 2×2 test was performed to determine the relationship between the RTT and the PPT for both MC and LC children at the three different age levels. None of the six contingency tables was significant.

4. *Effect of Intelligence*

a. *Decentering as a function of age and intelligence.* Although an attempt was made to control intelligence through testing only brighter LC S s, this procedure was not entirely successful; and, in addition, there appeared to be a general increase in IQ with age in both samples which raised the question of whether the age differences are due to the increasing ability to decenter on these two tasks as a function of age, or are the results due to initial IQ differences between age levels on the PPT. When the variation due to

IQ was extracted, analysis of covariance revealed significant differences between age ($F = 99$ for 1 and 87 *df*, $p < .01$). An analysis of covariance, to test the differences between age levels on the RTT when the variation due to *IQ* was extracted, revealed significant differences between age ($F = 25$ for 1 and 87 *df*, $p < .01$). Thus, initial differences on *IQ* between ages did not affect significant differences over age on decentering.

b. Decentering as a function of social class and intelligence. An analysis of covariance to test the differences between classes on the PPT, when the variation due to *IQ* was extracted, revealed no significant differences between MC and LC children ($F = .09$, for 1 and 87 *df*, not significant).

An analysis of covariance to test the differences between classes on the RTT, when the variation due to *IQ* was extracted, revealed no significant differences between MC and LC children ($F = 1.88$ for 1 and 87 *df*, not significant). Thus, when initial differences on *IQ* between classes are controlled, there is no significant difference between classes in decentering.

c. Relationship between objective and interpersonal decentering with intelligence controlled; partial correlation between objective and interpersonal decentering scores, with the effects of intelligence controlled. The correlations were .25, .00, and .35 at the 7, 9, and 11 year groups, respectively. Only the 11-year-old group is significant ($p < .01$, $N = 30$). Thus, when the effects of intelligence are partialled out, the correlations between the decentering scores became even smaller at the three age levels.

d. Relationship between the two forms of decentering with intelligence. The correlations between *IQ* and PPT were .25, .32, and .44 at ages 7, 9, and 11, respectively (r at age 11 = .05). The correlations between *IQ* and RTT were .09, .11, and .24 at the three age groups.

D. DISCUSSION

The results of the present study substantiate two of the three hypotheses tested. Objective decentering increased with age, which agrees with the previous findings of Piaget and Inhelder (15). Decentering on the Feffer Role-Taking Test also increased with age, which agrees with the previous findings of Feffer and Gourevitch (7).

Lower-class children scored lower in both decentering tests at each age level when compared with middle-class children. When the initial variation due to intelligence was controlled through analysis of covariance, the difference between middle-class and lower-class children was not significant on either objective or interpersonal decentering. That intelligence accounts for these

differences is not totally unexpected. The initial hypothesis was that cultural deprivation would operate to curtail the child's conceptual development, which would be reflected in his decentering score. Since the *IQ* is simply one other measure of cognitive ability, this finding is not surprising, and doubtless simply reflects the depressing effect of environmental deprivation in the LC. Elkind and Scott (4) have shown that individual differences in *IQ* were correlated with perceptual abilities on an ambiguous picture test. Wolfe (19) has shown the relationship between verbal intelligence and role taking. It should be noted that the correlations between the PPT and *IQ* are higher at each age level when compared with the correlations between the RTT and *IQ*. The objective decentering task is probably more comparable to items on the standard intelligence test than the more interpersonal decentering required on the interpersonal decentering task. Another interesting finding on the objective decentering task (PPT) was that the variability increased as a function of age, in the LC group. This finding is similar to Hunt and Dopyera's (11) results on adolescent conceptual level. Hunt and Dopyera found that the overall mean conceptual level was higher for MC children, while the standard deviation was lower, when compared to LC children. These findings, taken together, put to question the common misconception that LC children decrease in variability as a function of age on all cognitive tasks.

The third hypothesis, that there would be a positive relation between objective and interpersonal decentering, was not substantiated. This result is not congruent with the previous findings of Feffer and Gourevitch (7), where objective decentering on conservation of substance problems was related to role-taking decentering abilities. That this relationship was not found may be due to the lack of quantitative comparability between the RTT and the PPT.

A major problem in studying variation of any verbally mediated response with age is the possibility that the variation may reflect the child's capacity under investigation. In the present study, the relatively infrequent occurrences of any very high RTT scores suggest that the task as presently used may not be appropriate for these age levels, even though Feffer reports its use with 8 year olds. Thus the fact that children increase in interpersonal decentering with age may not only be a function of decentering ability *per se*, but also a result of increasing verbal skills which facilitate the comprehension of the task. It might be useful to devise an objective decentering task for older age levels and compare it with the RTT on older children where this measure may be more verbally appropriate. If the correlation turns out to be positive, the present criticism of the RTT at early age levels seems plausible.

E. SUMMARY

In summary, the present study verified two of the three hypotheses tested. Decentering on both the impersonal objective task and the interpersonal task increased with age. Lower-class boys scored lower on both decentering tasks than did middle-class boys. However, when initial differences in intelligence were considered, the differences between classes disappeared. It was noted that this result was not totally unexpected, since differential environments probably affect intelligence as well as decentering ability. The decentering increase with age remained significant with intelligence controlled. The hypothesis that objective and interpersonal decentering would be related was not substantiated. Lack of comparability of the measures and differential level of difficulty were suggested as possible explanations for this lack of relationship.

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THE COORDINATION OF PERSPECTIVES BY MENTALLY DEFECTIVE CHILDREN*

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A. INTRODUCTION

The present investigation attempts to throw some light on the ways in which mentally defective individuals perceive space, and specifically on their ability to interrelate their own point of view with that of other observers when presented with a given stimulus situation. This is a problem that has been extensively studied in normal children by Piaget and Inhelder in the context of their research into the development of concepts of space (4). They found that younger children (6-7 years) passed through an "egocentric" stage in which they confused their own point of view with that of other observers, when tested in an experimental situation with models of three mountains possessing cues to position. Older children (8-10 years), on the other hand, were able not only to perceive their own point of view as different from that of other observers, but could also designate the viewpoint of others. In Piaget's terms, they could "coordinate perspectives" (4, Chapter 8) in that they could, in their thought, move from one aspect of the stimulus situation to another in a flexible way.

The broad aim of the experiments reported in this study was to establish whether responses given by mental defectives in a situation similar to that used by Piaget and Inhelder fall into the same sequence of stages that was observed in normal children.

B. METHOD AND RESULTS

Forty subjects, all resident in an institution for mental defectives in South Australia, were drawn from four age groups: 8-9, 10-11, 12-13, and 14-15. Each group consisted of 10 subjects, the mean *IQ* for each group was 55. Subjects with Mongolism or other specific defects were excluded. Two series of observations were made for each child: the second was a simple supplement to the first.

The first experiment involved a stimulus situation with the following objects:

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a model church with a spire and measuring overall $14 \times 8 \times 16$ cm, a black telegraph pole 10 cms high, a green hedge $4.5 \times 1 \times 2$ cms, and a green Dinky Toy car measuring $7 \times 3 \times 2$ cms. Four full size photographs (48×32 cms) were taken of the arranged stimuli, from positions A, B, C, and D. Position A showed the "front view" of the church with the hedge to the right, the pole to the left, and the car behind the church and so out of sight. Position B showed the right-hand side view of the church with the hedge in the foreground, car to the right, and the pole, only the top of which could be seen, to the left of the spire. Position C showed the back view of the church with the hedge to the left, car in the foreground, and the pole to the right. Position D showed the other side of the church with the pole in the foreground, car to the left, and hedge behind the church.

The objects were arranged by the experimenter on a table at which the subject was seated, and while they were being set out the subject was asked to identify each object by name and point to it in the photographs which were pinned to a board about 1.5 meters in front of the subject. In this way the subject's attention was drawn to each object and to its position in the pictures. The subjects were then asked to point to the photograph that showed his own point of view, with the explanation, "If you were taking a picture from where you are sitting, which picture would be the one you would take?" Subjects were next shown a doll which was said to be taking pictures from positions B, C, and D, and they were asked to identify the pictures "taken from each position." After each choice the subjects were asked why they had chosen "that particular photograph."

Responses were scored as "veridical" when the subject pointed to the photograph corresponding to the position designated. All other responses, of course, were wrong. However, for the purpose of this experiment the "egocentric" have been presented separately from other "wrong" responses. An "egocentric" response was one in which, for positions B, C, or D, the subject pointed to the photograph for position A (or what he himself could see). Any other responses that the subjects gave were classed "wrong."

The second experimental task involved a simple spatial arrangement of six stimuli on the table in front of the subject. The same four objects from the first experiment were used, together with two models of houses. An assumption underlying this experiment was that only subjects at the lowest developmental stage would be unable to arrange the stimuli in an order corresponding to that shown in a different photograph that was on the board in front of the subject. The task therefore involved making a simple one-to-one correspondence between objects on the table and the same objects shown in the photograph. Such

a task is primarily perceptual, and the results were expected to give some information about whether the subjects could appreciate relationships between two-dimensional displays and their three-dimensional counterparts. Responses were scored on the basis of whether there were "gross" errors made in the arrangement, whether there were only errors of "positioning" or "orientation," or whether the objects were correctly set down.

The results of these two experiments are shown in Tables 1 and 2.

TABLE 1

PREDOMINANT RESPONSES FROM EACH GROUP IN THE COORDINATION OF PERSPECTIVES TASK

Age group	N	Own position recognized	For position B, C, and D predominantly		
			Wrong	Egocentric	Veridical
8-9	10	4	8	2	0
10-11	10	5	6	4	0
12-13	10	8	2	4	4
14-15	10	8	1	4	5

TABLE 2

CLASSIFICATION OF ORGANIZATION OF OBJECTS IN THE SIMPLE CORRESPONDENCE TASK

Age group	N	Errors		Correct
		Gross	Position	
8-9	10	3	7	0
10-11	10	2	6	2
12-13	10	3	2	5
14-15	10	1	2	7

C. DISCUSSION

The simplest classification of responses in the first experiment was in terms of whether there were predominantly "wrong," "egocentric," or "veridical" choices for positions B, C, and D. As only half of the egocentric or veridical responses were entirely consistent over the three choices, an exact specification of age boundaries in the development through the stages is impossible, and one can only speak of *predominant patterns* at any age, or in a single individual. Classifications to "age-groups" is entirely arbitrary, since, as Table 1 shows, the pattern of responses for the 12-13 and 14-15 year olds is essentially the same.

Although this study has not used a large sample, it is clear that the pattern of predominant responses follows the same sequence suggested by Piaget, whose data were derived from normal children. Although egocentricity and an ability to coordinate perspectives are *broadly* related to chronological age, the emer-

gence of these stages is much slower in mentally defective than in normal children.

At least some of the "wrong" responses given by the subjects in the 8-9 and 10-11 age groups are due to an inability to understand the task they were expected to perform. Such responses predominate in the 4-6 age range in normal children, called Stage I by Piaget, and it seems that the responses of subjects in this age group are comparable with those of our 8-9 and 10-11 year olds. Those subjects who correctly recognized their own position can probably be said to have understood the task. Six of these gave egocentric responses, the rest being wrong but not yet egocentric.

In normal children egocentric responses appear between 6½ and 8 years (4, pp. 213-233), while responses indicating an ability to coordinate perspectives appear between 8 and 10 years roughly. In the present sample of mental defectives, however, these responses occurred at the 12-13 age as frequently as in the 14-15 age. Such overlapping shows that chronological age as such can only roughly suggest the type of response to be expected. The same point has been emphasized by Piaget. There are a few "wrong" responses from older children, which are of course qualitatively different from those of the younger children. A subject who is able to pick out his own point of view may still choose a wrong picture for the position appropriate for another observer. This shows an awareness that a certain point of view is not their own, yet they cannot identify it correctly, and indicates the transition from the egocentric to the "veridical" stage in both normals and mental defectives.

In the second experiment, there are subjects in each group who made errors in arranging the objects to parallel the photograph, although in the oldest group these mistakes are in all cases errors of detailed positioning rather than gross errors of arrangement. This suggests a lack of the expected ability to discriminate (perceptually), perhaps because of inattention to the task, rather than an inability to recognize one-to-one relationships.

D. CONCLUSIONS

The present study has applied Piaget's formulation concerning egocentricity in perceptual functioning to a group of mental defectives, and the results suggest that the broad path of development is the same as it is for normal children. Overlapping of the stages of development makes it impossible to define exactly an age at which certain abilities may be expected to appear. Before the influences which bear on the emergence of later stages can be specified, it is necessary to clarify the broad developmental sequence, as the authors have attempted here. Although the coordination of perspectives is a relatively unexplored area, it

has attracted the interest of investigators who have applied these concepts to the study of interpersonal perception. Feffer (1) and Feffer and Gourevitch (2), for example, showed that the concepts of "centration," or the inability to shift which underlies egocentricity, and "decentration," or the ability to move from one aspect of a situation to another, are useful in understanding role-taking behavior in a projective-type test. Flavell (3) found that communicative skills develop as a function of "decentration." Younger children are very inept with these skills, which develop considerably during middle childhood and early adolescence as the ability to "decenter" develops.

However, research concerned with an understanding of the development of some of the subtle abilities to which Piaget has drawn our attention should not try to be parametric while the process itself is unclear. Further studies are needed to explore possible approaches for later parametric studies which might be applied to the measurement of mental functioning.

E. SUMMARY

To define further the developmental sequence of perceptual egocentricity, Piaget's formulation was applied to groups of mental defectives aged 8 to 15, with a mean *IQ* of 55. The stimulus material required Ss to relate points of view from a display of objects to photographs of the same objects, and then arrange objects to reproduce a photograph. The broad path of development was found to be the same as for normal children, although overlapping of the stages of development makes it impossible to specify exactly an age at which particular abilities to coordinate might appear.

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SEARCH FOR CHILDREN SHOWING ACADEMIC PROMISE IN A PREDOMINANTLY NEGRO SCHOOL*

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A. INTRODUCTION

In spite of the serious concern of most educators today, relatively little is still known as to the actual potential of the Negro elementary school child.

It is generally believed that intelligence of northern Negro students is on the average lower than that of groups of white students of similar socioeconomic status. However, data are still largely lacking.

The present study was carried out at the request of the Fund for the Advancement of Education of the Ford Foundation, in a largely Negro public school in New Haven, Connecticut.

The purposes of this study were first to compare responses for the group as a whole with responses of children of other racial, social, and intellectual levels, in order to determine whether or not behavior patterns for Negro children here examined develop in about the same manner and at about the same rate as do those of children from other groups; and second to identify those children who appeared to show academic promise. (By academic promise the authors mean simply that the child in question gives evidence of having the ability to finish high school with creditable performance and perhaps to continue beyond high school. Subjects were considered to show academic promise if their response equalled or exceeded the average response found in a group of children from North Haven who were comparable to present Negro subjects in *IQ* and socioeconomic status.)

B. SUBJECTS

This paper reports findings on 388 Negro children enrolled in the Abraham Lincoln School in New Haven, Connecticut, in the school year from fall 1964 to spring 1965. There were 56 kindergarten children examined, 95 first graders, 70 second graders, 61 third graders, 64 fourth graders, and 42 fifth graders.

Tests used were two projective tests, the Rorschach (6) and the Lowenfeld Mosaic (9), administered to all students; the Gesell School Readiness Tests

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(7) administered to all kindergarten through second-grade students, and the Slosson Intelligence Test for Children (11) administered to fifth-grade students only. All tests were administered individually.

Not all children in each grade were examined. Choice of those to be tested was based on age and color. It seemed fair to assume that children much older than the average, being mostly repeaters, would not be likely to show academic promise. Also keeping children to a fairly standard age range (5 for kindergarten, 6 for first grade, etc.) made possible comparison of present data with those from other school groups. The few white children attending Abraham Lincoln were omitted in the present study.

IQ ratings were not available for all Negro subjects, since group testing was not permitted. However, the authors did administer the Slosson Intelligence Test to all fifth-grade subjects. Mean *IQ* was 93, median *IQ* was 90. For other (white) groups whose responses are compared to present findings, North Haven subjects have a mean *IQ* of 105, Weston subjects a mean *IQ* of 110, and New Haven subjects a mean *IQ* of 118.

As to socioeconomic status, as measured on the Minnesota Scale (8) parents of present Negro subjects were of "slightly skilled" socioeconomic status, parents of North Haven subjects of "clerical, skilled, or retail business" status, those of Weston subjects of semiprofessional status, and those of New Haven subjects of semiprofessional or professional status. Obviously, North Haven subjects are most like Abraham Lincoln subjects in both *IQ* and socioeconomic status.

C. RESULTS

1. *Children Showing Academic Promise*

Children were considered to show academic promise if their performance was creditable (that is, at or above the mean of a somewhat similar and presumably "average" group of children from North Haven) on either the Rorschach or Mosaic Test or on both.

As Table 1 shows, the percentage of children in each grade who, in the authors' opinion, show academic promise ranges from 18 per cent to 39 per cent. For the total group, the percentage of children showing academic promise is 33 per cent of all children examined.

Since intelligence test scores were largely lacking, the authors determined the socioeconomic status of fathers for children in this academically promising group. One and one-half per cent had fathers at Level I of the Minnesota Scale, 2 per cent at Level II, 12 per cent at Level III, 12 per cent at Level V, 38 per cent at Level VI, 9 per cent at Level VII, and 26 per cent had no

TABLE 1
PERCENTAGE OF NEGRO CHILDREN SHOWING ACADEMIC PROMISE, BY GRADE

Subjects	K	Grade I	Grade II	Grade III	Grade IV	Grade V	Total
No. examined	56	95	70	61	64	42	388
No. showing promise	22	37	24	11	21	13	129
% showing promise	39	39	34	18	33	31	33

fathers. Thus it does not appear necessary that a child come from a family of high socioeconomic standing or even from a presumably stable home in order to show academic promise.

2. Behavior Changes with Age

a. Mosaic Test. Responses of Negro subjects to the Lowenfeld Mosaic Test (2, 4, 9) are given in Table 2, which also tabulates responses of the three white groups with which present data are compared. As this table shows, for Negro children, unpatterned, nonrepresentational products (Class A) diminish sharply from 5 through 5½ and 6 years, predominating only through 5½ years. At 6 years, representational products (Class C) predominate.

TABLE 2
ABRAHAM LINCOLN (AL) MOSAIC RESPONSES COMPARED WITH RESPONSES OF
CHILDREN FROM NORTH HAVEN (No), WESTON (W), AND NEW
HAVEN (NH) RESEARCH GROUPS

Subjects	Percentage of responses in each Mosaic category											
	5 years				5½ years				6 years			
	AL	No	W	NH	AL	No	W	NH	AL	No	W	NH
All A	63	28	29	11	49	27			40	24	17	2
All B	14	14	16	28	28	19			6	15	25	24
All C	23	57	54	59	22	54			50	56	53	69
Mixed	0	0	0	2	0	0			4	5	5	5

7 years				8 years				9 years				10 years			
AL	No	W	NH	AL	No	W	NH	AL	No	W	NH	AL	No	W	NH
23	25	18	1	8	13	10	5	9	8	23	7	10	6	19	12
15	19	20	30	32	20	12	27	15	28	10	32	20	18	16	30
62	52	62	62	60	64	73	59	66	62	67	57	70	75	65	57
0	4	0	7	0	3	5	9	9	2	0	4	0	1	0	1

Note: Class A = nonrepresentational designs without pattern, Class B = nonrepresentational designs with pattern, and Class C = representational designs.

This is a normal, usual, and expected trend. Though immature patterns (Class A) continued slightly longer in Negro students than in other subjects, nonetheless these children follow the same pattern of development as do other groups in that Class B (patterned nonrepresentational products) and Class C (representational) products do with increasing age take the place of Class A. In fact Negro subjects show a predominance of patterned products only six months later than do white subjects. This is clearly not a serious discrepancy.

b. Rorschach Test. Responses to the Rorschach Test for subjects 5 to 10 years of age are summarized in Table 3. Since this is a highly technical test,

the meaning of the various scores and kinds of response will not be detailed here but are discussed at length in a separate paper by Ames and August (3). The significant thing here is that the Rorschach responses of the Negro boys and girls, unlike the responses to every other test here described, *do not improve substantially with age*.

Table 3 also compares responses of like-age North Haven and Abraham Lincoln subjects for each of the usual Rorschach score variables. [Means for m and F(C) are omitted, since in Negro subjects neither score at any age exceeds .2.] In a few instances the response of the two groups is equal, but for most variables at most ages the Abraham Lincoln performance is below that of the North Haven subjects. (For F per cent and W per cent the Abraham Lincoln score is higher than the North Haven score, but for those two variables a low score is the more desirable.)

Significantly, for most variables the Abraham Lincoln subjects most clearly approximate the North Haven performance at 5 years of age. Thereafter, the discrepancy in favor of North Haven subjects increases. The outstanding exception is F+ per cent. This percentage is high and is well maintained by the average Abraham Lincoln child at all ages.

However, it should be noted that this high accuracy is maintained in the same way that the aging subject (10) maintains good accuracy—by severely limiting the response in other directions. Thus the Abraham Lincoln child as he grows older tends to give fewer responses, does not differentiate his response by giving an ordinary number of D (detail) responses, does not as do all other groups in this age range give an increasing number of movement and color responses with increasing age.

The Negro child does maintain accuracy, but at a great price.

c. *Copy Forms*. Comparing the performance of Abraham Lincoln Negro 5 to 7 year olds with that of North Haven white subjects on Copy Forms Test, we find that in general behavior trends are highly similar.

As to rate of development, Abraham Lincoln children are slightly, though for most tests not substantially, behind North Haveners. This suggests that at the present time and under the present circumstances, Abraham Lincoln children express themselves as being somewhat less mature, and are developing a little more slowly in behavior function, than are North Haven children.

As Table 4 shows, both groups copy circle from the top and draw in a counterclockwise direction at the same age: i.e., $5\frac{1}{2}$ years. For most other tests, Negro subjects achieve success on the several copy forms tests about six months later than do the white children. However, contrary to the situation which exists with the Rorschach findings, both groups seem to be proceeding

TABLE 3
ABRAHAM LINCOLN RORSCHACHS *vs.* NORTH HAVEN

Rorschach variable	Subjects	5 yrs.	5½ yrs.	6 yrs.	7 yrs.	8 yrs.	9 yrs.	10 yrs.
N	No. Haven	11	10	13	11.0	12.8	12	14
	Ab. Linc.	11	10	8	9.4	8.8	10	10
	Difference	=	=	- 5	- 2	- 4	- 2	- 4
F%	No. Haven	81%	74%	73%	73%	68%	70%	72%
	Ab. Linc.	84%	91%	86%	79%	81%	76%	78%
	Difference	+ 3	+17	+13	+ 6	+13	+ 6	+ 6
F+%	No. Haven	75%	89%	86%	92%	87%	92%	94%
	Ab. Linc.	57%	63%	78%	86%	87%	90%	91%
	Difference	-18	-26	- 8	- 6	=	- 2	- 3
W%	No. Haven	66%	68%	70%	67%	58%	62%	58%
	Ab. Linc.	74%	75%	71%	75%	71%	67%	78%
	Difference	+ 8	+ 7	+ 1	+ 8	+13	+ 5	+20
Dd%	No. Haven	5	4	5	5	5.5	5.5	6
	Ab. Linc.	1	0	4	0	3	0	1
	Difference	- 4	- 4	- 1	- 5	- 2.5	- 5.5	- 5
D%	No. Haven	30%	29%	25%	28%	37%	33%	36%
	Ab. Linc.	25%	25%	25	25	26	30	21
	Difference	- 5	- 4	=	- 3	-11	- 3	-15
M	No. Haven	.32	.62	.40	.70	1.1	1.4	1.9
	Ab. Linc.	.70	.26	.40	.50	.4	.6	.7
	Difference	+ .38	- .36	=	- .20	- .7	- .8	- 1.2
FM	No. Haven	.56	.63	1.04	.99	1.77	1.27	1.7
	Ab. Linc.	.40	.11	.40	.50	.6	1.00	.7
	Difference	- .16	- .52	- .64	- .49	- 1.2	- .27	- 1.0
sC	No. Haven	.78	.93	.98	.78	.87	.86	.55
	Ab. Linc.	.45	.47	.24	.07	.60	.40	.30
	Difference	- .33	- .46	- .74	- .71	- .27	- .46	- .25

TABLE 3 (continued)

Rorschach variable	Subjects	5 yrs.	5½ yrs.	6 yrs.	7 yrs.	8 yrs.	9 yrs.	10 yrs.
A%	No. Haven	47%	53%	52%	57%	53%	55%	56%
	Ab. Linc.	45	58	61	60	71	65	69
	Difference	- 2	+ 5	+ 9	+ 3	+18	+10	+13
H%	No. Haven	18%	14%	16%	15%	17%	20%	20%
	Ab. Linc.	22	13	11	10	5	7	12
	Difference	+ 4	- 1	- 5	- 5	-12	-13	- 8
No. of content	No. Haven	4.1	3.7	2.1	3.4	4.5	3.8	4.2
	Ab. Linc.	3	3.6	3.0	3.2	2.6	3.5	3.0
	Difference	-1	- .1	+ .9	- .2	- 1.9	- .3	- 1.2

at the same rate, and Negro children do not (as in the Rorschach) fall increasingly far behind.

d. Incomplete Man Test. Response to the Incomplete Man Test is rather complex, involving as it does a minimum of 10 separate scorable items (5). Since children vary tremendously in their individual response (being ahead of their age in the drawing of some parts of the man and behind in others), a comparison of the average response of one group of subjects with that of another is difficult.

However, when we compare the average response of the Negro child with that of the white North Haven subject, it appears that there is a striking similarity of response in children of the two groups on this particular test. As Table 5 shows, only for a few parts is the white subject ahead.

The most outstanding difference in performance of the two groups of children has to do with their naming of the figure. From 5 through 7 years of age the majority of the North Haven subjects named the figure a "man," but the majority of Abraham Lincoln children called him a "boy," an immature response reflecting, perhaps, a less fully developed sense of self.

e. Writing name and numbers. North Haven subjects are ahead of Abraham Lincoln subjects in name writing at 5 years of age. At 5½ years, however, Abraham Lincoln subjects are conspicuously ahead in writing their names. At 6 years, Abraham Lincoln girls but North Haven boys are ahead (see Table 6). By 7 years of age, performance is nearly equal. The marked advance of this group of Negro subjects at 5½ years (a small and superior group, it is true) is noteworthy.

Table 6 also gives percentages of children who show varying degrees of success in writing numbers. As this table shows, at 5 years of age, North Haven subjects of both sexes are ahead. At 5½, however, the North Haven girls are ahead, but the Abraham Lincoln boys. At 6 and 7 years, North Haven subjects of both sexes write more numbers than do Abraham Lincoln subjects.

3. Rectilinear vs. Normal Curve

Though *IQ* scores are available for members of only one of the school grades here studied, they fall in such an unusual distribution that the authors present them here in Figure 1, which gives the distribution of *IQ* scores for 42 fifth-grade Negro subjects. As will be seen, though range of scores is wide—from 74 to 128—this curve is far from bellshaped, and close to two thirds of the scores fall below the midpoint.

The absence of a normal bellshaped curve when plotting the distribution of scores of products of these same Negro children was also noted by Walker

TABLE 4
RESPONSE TO THE COPY FORMS TESTS, NORTH HAVEN AND ABRAHAM LINCOLN
(Compared ages 5 to 7)

Response	North Haven	Abraham Lincoln
Organization on page		
Place on paper	Horizontal alignment (boys only) 7 years 1/2 to 1 page, 5 years	Horizontal alignment not achieved 1/2 to 1 page, 5 1/2 years
Amount of space used		
Copy circle		
Starts at top	5 1/2 years	5 1/2 years
Direction CCW	5 1/2 years	5 1/2 years
Copy cross		
2 lines, vertical then horizontal	4 1/2 years	5 years (may be sooner; no data on 4 1/2)
Copy square		
1 line, left side down, continuous	5 years	5 1/2 years
Copy triangle		
2 lines, starting down left side	Varied	5 1/2 years
Divided rectangle		
Cross-over patterns	5 1/2 years	7 years
Horizontal diamond		
Young forms no longer predominate, both sexes	5 1/2 years	7 years
Vertical diamond		
Young forms no longer predominate, both sexes	5 1/2 years	6 years

TABLE 5
FIRST AGE OF ACHIEVING GOOD FORM OR PLACEMENT: NEGRO *vs.* WHITE
RESPONSE TO INCOMPLETE MAN TEST AT 5 TO 7 YEARS

Part	Abraham Lincoln	North Haven
Eyes		
Good place	7 years	6 years
Even	5 years	5 years
Matching	5½ years	5 years
Hair		
Good number	—	—
Good place	—	—
Approx. good length	—	7 years
Neck		
Bodyline, neck and bow	7 years	7 years
Arm		
Good place	5½ years	5 years
Points upward	5½ years	5½ years
Good length	—	—
Leg		
Good place	—	—
Good direction	—	—
Good length	—	—
No. of parts		
5 years		
5½ years	8.8	9
6 years	8.5	9
7 years	10	10
7 years	10	10
Omits extra parts and marks	5½ years	5 years

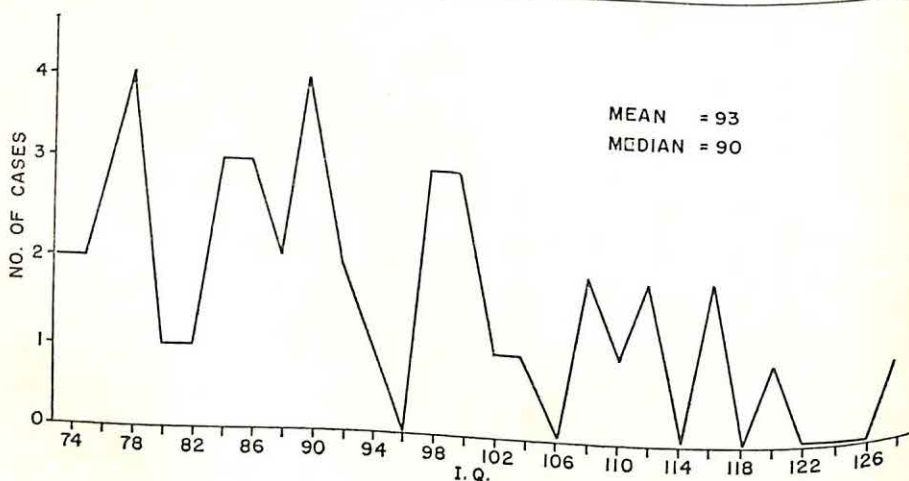


FIGURE 1
IQ (SLOSSON INDIVIDUAL INTELLIGENCE TEST) FOR 42 TEN-YEAR-OLD
FIFTH-GRADE ABRAHAM LINCOLN SUBJECTS

TABLE 6
 WRITING NAME AND NUMBERS, ABRAHAM LINCOLN AND NORTH HAVEN SUBJECTS COMPARED
 (Percentage of responses)

Response	5 years				5½ years				6 years				7 years			
	Girls		Boys		Girls		Boys		Girls		Boys		Girls		Boys	
	NoH	AbL	NoH	AbL	NoH	AbL	NoH	AbL	NoH	AbL	NoH	AbL	NoH	AbL	NoH	AbL
<i>Name</i>																
No response	4	36	20	55	0	0	0	0	0	0	0	0	0	0	0	0
Random letters	26	54	24	25	4	0	2	0	0	0	0	0	0	0	0	0
First name only	44	9	36	19	42	0	46	0	10	0	10	20	2	4	4	8
First letter or letters, last name	10	0	12	0	10	11	30	0	20	9	16	20	0	0	0	4
First and last names	16	0	8	0	44	88	22	100	70	92	74	60	98	96	96	98
<i>Numbers</i>																
No record	16	27	18	50	2	0	4	0	2	0	2	2	0	0	0	0
1-5	38	72	66	50	20	0	24	20	6	4	2	6	0	0	0	0
1-6 (up to 10)	30	0	6	0	40	22	36	20	14	44	14	14	2	16	0	0
1-11 (up to 20)	16	0	10	0	38	72	36	60	78	52	82	78	98	84	100	100
1-20	2	0	0	0	16	0	8	20	42	16	56	42	96	64	100	100

in an unpublished study on creativity on the same group of subjects. Walker notes that "in most school classrooms one expects to find a big middle group of children, more or less comparable in their thinking and learning, along with a few quicker and a few slower ones. In these classrooms (Abraham Lincoln school Negro children) the children appeared to spread out over an unusually wide range."

Should this turn out to be the case with test scores of other Negro subjects on other tests, it would be of considerable educational significance.

4. Rank Order

When a group of average to superior white children is examined on a battery of tests, such as the Rorschach, Mosaic, Incomplete Man, and Copy Forms, and responses for each test are arranged in rank order from best to worst, there is a strong tendency for those children who rank best on one test also to rank best on the others and *vice versa*, rank order tending to be rather consistent from test to test. Furthermore, if the same group of children is examined on some one test year after year, rank order tends to remain highly consistent from year to year (1).

That is, in a group of children of good endowment, outstanding children remain outstanding from one test to another and from year to year on the same test. Excellence of performance tends to be accompanied by consistency of performance.

For present subjects, Rorschach and Mosaic Test responses were available for all grades from kindergarten through fifth; and from kindergarten through second, Gesell behavior test responses were available as well. Rank order comparisons of these data show some slight tendency for one or two students at the top of any grade to be consistently high on all tests, and for one or two at the bottom to remain consistently low. But for the most part there appeared to be relatively little consistency of rank order of any one child from test to test. Girls in general were slightly more consistent than were boys.

D. DISCUSSION

Findings of the present study suggest that the response of the average Negro primary school student may differ from that of the average white student in ways which we as yet know little about. The authors propose research in depth to determine what the performance and potential of the Negro student really is and to attempt to discover in what abilities he falls short of the white student, in what abilities he may be equal, and in what abilities he may excel.

Present findings suggest the following:

First, for most aspects of behavior studied here—intelligence, projective tests (Rorschach and Lowenfeld Mosaic), behavior tests (Copy Forms and Incomplete Man)—the response of the Negro child falls considerably short of that of the white child of the same age and approximate socioeconomic status.

However, except for the response to the Rorschach Test, the response of the Negro child develops in a normal direction and at an approximately normal—even though slower—rate. The response of the Negro child ranges from six months to one year behind that of the white child, but for the most part is not otherwise atypical. The Rorschach response is an exception.

The Rorschach response, according to Lowenfeld (9), tells us how the child experiences in contrast to the Mosaic, which tells how he functions. The Mosaic response of the Negro child, though somewhat sparse and developing at a slower rate than that of the white child, does clearly “improve” in the usual manner with age. The Negro Rorschach response, on the contrary, is more like that of the white child at 5 years than it is at 10 years of age. It does not show the usual improvement and development with age.

The one exception is the F+ per cent (correct form per cent). This is maintained well and at a high level but it is maintained at the expense of creativity and enlivenment of response. The child maintains good form by giving fewer responses, by refusing difficult cards altogether, by giving more banal responses, and by restricting himself to form responses.

Since the Rorschach response is one of the most significant tested in the present study, since more than the other tests it tells us what the child is like as an individual and how richly he experiences the world and responds to it, it is of some concern that the Rorschach response of the Negro child is as sparse and unenlivened as it appears to be. The question arises, how can we help him to conform (as expressed by his F+ per cent), without cutting down on his creativity and productiveness?

Second, when a group of average to superior white primary school children are examined on a battery of tests (as Rorschach, Mosaic, Incomplete Man, and Copy Forms) and the responses for each test are arranged in rank order from best to worst, there is a tendency for those children who rank best on one test also to rank best on the others, and *vice versa*. Also, if the same group of children are examined on some one test year after year, rank order tends to remain highly consistent from year to year. Excellence of performance tends to be accompanied by consistency of performance. Though some consistency from test to test was noted in present Negro subjects, it did not hold up as well as in groups of white children studied up to now.

Third, there is some suggestion that the response of a group of Negro primary children to behavior, projective, and intelligence tests tends to fall in a rectilinear distribution rather than along a normal curve, or even that there is a marked bunching at the lower end of any scoring scale. Classes of Negro children appear to lack that large middle group which characterizes classes of white children. There are students who fall at the top end of any scale, others who fall in the middle range, but the largest number seem to fall in the bottom half of the range. Reference to Figure 1 shows that so far as *IQ* of present Negro fifth grade subjects is concerned, three quarters of the subjects fall in the bottom half of the *IQ* range: that is, they have an *IQ* of 100 or under.

This suggests the importance of correct and discriminative grouping. Instead of keeping the entire class (of 5 year olds, 6 year olds, or whatever) together and attempting to teach toward the middle 50 per cent as is practical when abilities fall along a normal curve, it appears that the top quarter (or third) of the children require, and could presumably benefit from, an entirely different kind of teaching from that required by the rest of the class.

This point is emphasized in the present study by the fact that approximately the top third of each class examined here was considered to show what the authors identify as "academic promise."

All of these considerations lead to the suggestion that before we can effectively help the Negro child fully to realize his educational potentials, we need to know a great deal more than we now do about what those potentials are. It is begging the question to assume that they are necessarily identical, or potentially identical, to those of the white child.

Furthermore, since it is especially important for the less well endowed or the slower developing child in any school group to be correctly placed in the kind of class and at the grade level for which he is suited, the authors suggest that it would be most useful at the beginning of each school year to give all children both intelligence and developmental examinations.

Many Negro children belong in an enriched class, many in a regular class. Others would undoubtedly profit by a slower course in the regular kind of class. However, any child whose intelligence measures (for whatever reason) 85 or under would probably do best if grouped separately from those of presumably superior or average intelligence and taught in a special class with others of similar endowment.

E. SUMMARY

Responses of 388 Negro elementary school children were compared with those of white children of similar age and socioeconomic level in order to

determine whether or not behavior patterns for the Negro children here examined develop in about the same manner and at about the same rate as do those of children from other groups, and to identify those Negro children who appeared to show academic promise. By academic promise is meant simply that the child in question gives evidence of having the ability to finish high school with creditable performance and perhaps to continue beyond high school.

The percentage of children showing special promise ranged from 18 per cent to 39 per cent per grade. For the total group, the percentage of children showing academic promise is 33 per cent of all children examined.

For most tests, Negro children develop in the same way but at a lower level and slower rate than do white children. Except for Rorschach Test responses, the course and stages of development were similar for the two groups. However, Rorschach Test responses of Negro children were most like those of white children at 5 years of age and fell progressively farther behind in the years from 5 to 10.

Perhaps most significant was the finding that performance of Negro children appears to fall on a rectilinear rather than along a normal curve, with an abnormally wide distribution and a marked bunching at the lower end of any scoring scale.

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FRIENDSHIP FLUCTUATION IN NORMAL AND RETARDED CHILDREN*¹

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A. INTRODUCTION

The developmental pattern of friendship stability has been investigated in studies by Horrocks and Thompson (12), Thompson and Horrocks (22), Horrocks and Buker (11), and Skorepa, Horrocks, and Thompson (20). The general procedure has been to ask the child to name his three best friends in order of preference, and then two weeks later to repeat the interview. The amount of change over the two-week period, in the choice and ranking of the friends, has been used as the index of friendship fluctuation. In general, the results of these investigations indicate a steady decrease in friendship fluctuation between the ages of 5 and 18. The authors interpret this finding as an indication of increased social maturity with increased chronological age.

The present study was designed to investigate the relationship between intellectual level and friendship fluctuation. One possible prediction is that there is a positive correlation between social maturity and intellectual development. This relationship is the basis of at least one widely used test of social maturity (5) and has been supported by a number of investigations. Mercer, Butler, and Dingman (17) have shown that school-age children who are retarded in social development or mental ability are likely to be retarded on both dimensions. Doll (4, p. 30) has observed "a high correlation between social competence and intelligence level." Capobianco and Cole (2), while studying play behavior, have found the social development of the retarded child more related to the level of intellectual maturity than to chronological age. Bomse (1) demonstrated that mentally retarded children were concerned with interpersonal problems similar to those which concerned normals of the same mental rather than chronological age. Clark (3) and Fisher (6) found that

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sex preference among retardates is also more closely related to mental age than chronological age. On the basis of this evidence, one might predict that intellectual level would also affect friendship fluctuation. Therefore, since Horrocks and Thompson (12) suggest that friendship is an index of social maturity, one could predict that retarded children would exhibit less friendship stability—that is, greater fluctuation—than would normal children.

A second, and completely contrary, prediction regarding the relationship between intellectual level and friendship fluctuation could be based upon the purported rigidity of the mentally retarded child. This latter theory, advocated by Lewin (16, chapter 7), views the retarded person as more rigid than his normal age mate. It has received some empirical support from Lewin (15) and Kounin (14). From this theoretical point of view, one might expect that the retardate's cognitive rigidity would influence his social relations, and result in decreased rather than increased friendship fluctuation.

More recent investigations, however, have challenged this rigidity theory. In two discrimination studies (18, 21) and in a series of satiation experiments (9, 19, 24), it has been demonstrated that the differences between normals and retardates reflect not so much cognitive rigidity as different motivations affecting the subjects and situational difficulties which are assessed differently by the normals and retardates.

In the light of these negative findings concerning the rigidity hypothesis, and of the largely positive findings concerning the relation between social and intellectual development, the following hypotheses were proposed. First, it was predicted that friendship fluctuation scores would decrease with increasing age for retardates as well as for normal children. This is based on the assumption (10) that the rate of development of retardates is similar to, but slower than, that of normals. Secondly, it was hypothesized that at each age level the amount of friendship fluctuation would be significantly greater for the retarded subjects than for normals. Finally, it was hypothesized that the extent of the decrease in fluctuation with age would be less for retarded than for normal subjects, as a result of the retardates' slower intellectual development.

B. METHOD

1. *Subjects*

The subjects for this study were 89 retarded and 223 normal boys and girls between the ages of 10 and 18 (9.5 to 18.5 years) from private boarding schools. Table 1 presents the number of boys and girls at the various ages for the experimental and control groups. All subjects were selected from boarding

schools, since previous research (7, 8, 23) has shown that propinquity and contacts with new people affect friendship selection and change. The experiment was conducted in November before any vacations had occurred and yet two months after the opening of school. In this way the possibility of new contacts from outside the school was limited, as was the likelihood that a child might still meet a new person within the school for the first time during the interval between interviews.

TABLE 1
AGE AND SEX DISTRIBUTION OF SUBJECTS

Chronological age	Retardates			Normals		
	Females	Males	Total	Females	Males	Total
10	1	5	6	—	5	5
11	3	1	4	—	7	7
12	6	6	12	—	17	17
13	3	4	7	—	22	22
14	6	3	9	11	31	42
15	7	9	16	18	32	50
16	8	5	13	15	15	30
17	4	10	14	16	18	34
18	3	5	8	10	6	16
Total			89			223

Retarded subjects came from boarding schools and included both boys and girls at each age level. Their *IQs*, as measured by individually administered tests, ranged from 45 to 85. There were no significant differences in mean *IQ* between the age levels. The majority of retarded subjects were diagnosed as brain injured, with approximately one-tenth classified as familial retardates.

The normal control subjects came from two preparatory schools, one for boys and another for girls, and from a prepreparatory school for boys. Consequently, the younger control subjects (from 10 to 13 years) were exclusively males. This would in no way affect the results, however, since Horrocks and Thompson (12) found that there were no statistically significant sex differences in friendship fluctuation rates at these age levels. The *IQs* of the normal subjects ranged from 104 to 145, as measured by group tests administered in September of that year. Once again, there were no significant differences between the *IQ* means at the various ages.

Since the tuition at each of the schools varied from \$3000 to \$6000 per year, and very few of the children were on scholarship, it can be assumed that they came largely from above average socioeconomic homes. Thus the backgrounds of the experimental and control subjects were comparable in all major respects except those stemming from their different mental levels.

2. Procedure

All of the normal control subjects were tested in groups of 15 to 20 members. Each subject was given a sheet of paper on which he was asked to write his name and age and to indicate if this was his first year at the school. The subjects were then asked to "Write the name of your best friend on the top line: that is, your best friend anywhere." The word "anywhere" was included in order to assure the subjects that their choices need not be limited to the members of the school, though, of course, they might be if the student so desired. The students were then asked to write the name of their next best friend, and finally the name of their third best friend. The same procedure was followed for the mentally retarded subjects except that each student was individually asked the questions orally and his responses were recorded by the experimenter. This alteration, in the procedure used with the retarded, limited the possibility of misunderstanding concerning the information desired and eliminated the problems connected with the subjects' attempts to write and spell their friends' names.

Eighteen to 19 days after the initial testing, the children were again asked to list their three best friends in order of preference. They were told that they might or might not list the same people previously named, but that it was important to write down the names of the people whom they liked best at the time of the second interview.

To measure the rather complex changes in friendship, the procedure designed by Horrocks and Thompson (12) was used. The three friends chosen by each subject during the second choice situation were compared with the friends chosen 18 to 19 days earlier. If the choices were identical both in names and rank order, the index of friendship fluctuation was considered to be zero. If the friends chosen the second time were the same as those selected the first time but differed in preferential order, a numerical value of one was given for each rank that separated the name from its original assigned position. For example, during the first testing, a subject named his friends in preferential order as John, Joe, and Dan and during the second interview listed them as John, Dan, and Joe. The score would be two, since both Dan and Joe each moved one position. If the subject had said Dan, John, and Joe, the score would be four, since John and Joe moved one position each and Dan moved two. If a subject during the second interview chose as his three best friends students whom he had not previously mentioned, the following numerical values were assigned to the new friends: two for an individual who had not previously been mentioned who became the subject's third-best friend, three

for a person not previously named who became the subject's second-best friend, and four for a person not mentioned originally who became the subject's best friend. The scores for the friendship positions were then totaled, yielding the subject's friendship fluctuation score.

C. RESULTS

Since some of the students had just come to the boarding schools during the year of this study while others had been enrolled for several years, the question arose whether the new students fluctuate more in their friendship choices than the students who had attended the school for more than one year. Hunt and Solomon (13) have demonstrated that after a few weeks at a summer camp there is no significant difference between the amount of fluctuation demonstrated by new and old campers. To ascertain if the same equalizing process had taken place among the subjects of this study, the old and new students in the 14- and 15-year-old control group were compared. The mean fluctuation score for the new students ($N = 40$) was 2.52, while that for the old students ($N = 52$) was 2.25. Since there was no significant difference between the mean scores for these two groups, it can be assumed that after a short time recent admission to the boarding school does not appreciably affect friendship fluctuation.

The relationship between chronological age and friendship fluctuation for the total groups of normal and retarded children is presented graphically in Figure 1. The curves for both groups indicate a downward trend, or increasing stability with age. The curve for the normal subjects is consistent with that reported by Thompson and Horrocks (22), while the curve for the retarded subjects indicates greater fluctuation at each age level.

Because of the small N at the lower ages, the 10 and 11 year olds were combined to make the N larger and more comparable to the 18-year age group. The data in Table 2 indicate that the mean change over the nine years is significant for both groups. This finding supports the initial hypothesis that there would be a significant age-related decrease in friendship fluctuation for both normal and retarded children.

Table 3 presents a comparison between the mean scores for the normal and retarded subjects, grouped into three year units. As might be predicted from an inspection of Figure 1, the differences are highly significant. These data support the second hypothesis: namely, that the amount of friendship fluctuation would be greater for the retarded subjects than for the normals.

The third hypothesis, concerning relative amount of decrease over the nine-year period, was not substantiated. An analysis of variance showed significant

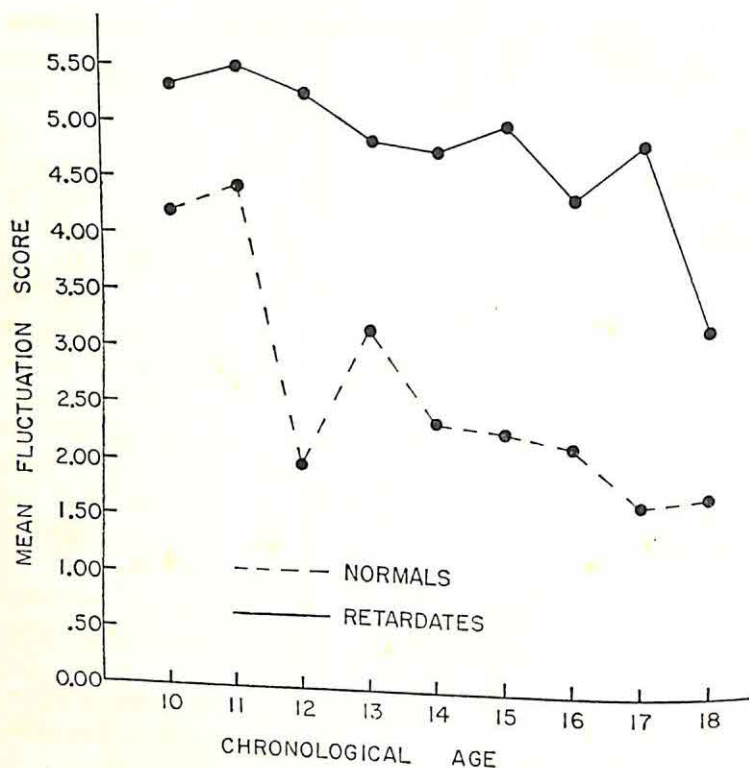


FIGURE 1
AGE CHANGES IN FRIENDSHIP FLUCTUATION FOR 223 NORMAL AND 89 RETARDED SUBJECTS

TABLE 2
AGE CHANGE IN MEAN FRIENDSHIP FLUCTUATION SCORES FOR NORMAL AND RETARDED SUBJECTS

Group	10-11 yrs.	18 yrs.	<i>t</i>	<i>df</i>	<i>p</i>
Control	4.33	1.75	3.11	26	<.01*
Retarded	5.40	3.25	1.84	16	<.05*

* One-tailed test.

TABLE 3
FRIENDSHIP FLUCTUATION SCORES FOR NORMAL AND RETARDED SUBJECTS AT THREE AGE LEVELS

Chronological age	Control Mean	Control SD	Retarded Mean	Retarded SD	<i>t</i>	<i>df</i>
10-12	2.9	2.63	5.32	2.63	3.09*	49
13-15	2.5	2.31	4.91	2.50	5.17*	104
16-18	1.9	2.18	4.31	2.33	2.90*	115

* $p < .01$.

differences between the age groups and experimental *vs.* control groups, but not significant interaction.

D. CONCLUSIONS

The data of this study demonstrate significantly greater fluctuation, or less stability, of friendship choice for the retarded than for the normal child. They also indicate that friendship fluctuation decreases with age for the retarded child as it does for the normal child. These findings have significance for at least three different concepts. First of all, the results add another piece of data to the growing body of evidence which demonstrates a relationship between social and intellectual development. Secondly, these data could not be predicted by a Lewin-Kounin theory of greater rigidity among the retarded than among normals. Rather, since the pattern of increased stability with age was observed in both groups, the data offer support for the idea of qualitative developmental similarity between normal and retarded children in the area of social development. Finally, one might ask whether the stability of other choices might also increase with intellectual development. Perhaps even non-social choices, such as one's favorite color or favorite food, become more stable with age as a result of increased mental development. Perhaps a certain commitment of any sort requires a given level of intellectual maturity. It is also possible that personality traits known to influence friendship choice become more stable with age and concomitant mental growth. These possibilities are currently being investigated in a series of experiments designed to measure changes in the stability of various psychological characteristics as a function of age.

E. SUMMARY

This study has investigated the relationship between intellectual level and friendship fluctuation. Earlier studies (11, 12, 20, 22) have examined the age-related changes in friendship fluctuation of urban and rural children, adolescents, and college students. The present study examined the hypothesis that decreases in friendship fluctuation are related to mental growth. Eighty-nine retarded children and 223 normal children between the ages of 10 and 18 were compared for friendship fluctuation over a two-week period. In both groups fluctuation decreased significantly with age. For every age group, the retarded subjects demonstrated greater friendship fluctuation than did the normal children. The data were interpreted as support for the relationship between intellectual and social growth, as well as for the notion of a qualitative similarity in the social development of normal and retarded children. It

was suggested that further research investigating the fluctuations of choices other than friends may prove fruitful in the developmental study of personality stability.

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COMPARATIVE DEVELOPMENT OF NEGRO AND WHITE INFANTS*¹

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A. INTRODUCTION

The paucity of recent investigations, conflicting results of other studies and their lack of statistical treatment and proper controls, and the age-old controversy of the superiority of the races make a comparative study of Negro and white development a vital area of research.

Williams and Scott (13) compared gross motor development, by means of the Gesell schedules, of a group of Negro infants from a low socioeconomic background with those from a high socioeconomic background. They found the infants from the low socioeconomic group to be significantly accelerated in gross motor development over the higher group. They also found significant differences in the way the infants from the two groups were handled; the ones from the lower background came from homes where, comparatively, the atmosphere was more permissive and less exacting. From the results of their study they say, "the findings suggest that motor acceleration is not a 'racial characteristic'" (13, p. 120).

Scott *et al.* (10) studied two groups of Negro infants from two contrasting socioeconomic backgrounds on 12 neuromuscular steps. They found the Negro infant from the clinic to be accelerated over the Negro infants from private practice from the 8th to the 35th week of life; after that the development was similar. The babies in this group (lower socioeconomic group) were accelerated in their development when compared with a group of white babies studied in a like manner by Aldrich (1), except in the two patterns of "smiling" and "vocalization." When the Negro group from private practice was compared with Aldrich's white sample from private practice, they noted a marked similarity during the first 30 weeks of life in their development. They thus attributed the differences and similarities found in the three groups studied to environmental factors.

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While McGraw (7) in her study found the development of Negro babies to be about 80 per cent as mature as that of white babies she tested, critics of her study have pointed out that the heights and weights of the Negro infants were considerably below those of the white babies, and, therefore, she did not have comparable groups.

Pasamanick (9) compared 53 Negro babies with 99 white infants and found Negro superiority in gross motor development, but no differences in the other categories measured by the Gesell test. In a follow-up on these infants, Knoblock and Pasamanick (5) found the Negro child to be equal in development to his white "coeval," but a definite acceleration was noted in the gross motor development of the Negro infant over the white child. In a later and more controlled study, Knoblock and Pasamanick (6) found no differences at 40 weeks of age between the two races. In an analysis of factors affecting development, they conclude that prenatal experience, birth weight, and later physical condition are the most important, "and, in essence, the only significant factors we have been able to discover at this point that result in group differences in developmental quotients" (6, p. 214).

Solomons and Solomons (11) studied the factors affecting motor development of 4-month-old infants and found firstborns to have a significantly higher motor score than later-borns. They found no significant differences between the mean motor score of Negro and white infants, although the Negro score was slightly higher than the white score.

Meredith (8), in summarizing weights and lengths of North American Negro infants, says that the Negro baby is, on the average, nearly 4 per cent lighter at birth than the average North American white infant and is .20 and .13 kilograms lighter at 6 months and 1 year, respectively. Although he found that the birth length of the North American Negro was shorter by about 1.0 cm than that of the white infant, there was no difference in mean length between the two groups after six months of postnatal age. Crump *et al.* (3), in discussing the factors influencing birthweights in Negro infants, concludes that the Negro is smaller at birth than is the white baby. However, they point out that it has not been demonstrated that this is exclusively a racial characteristic. The factors they found to influence birthweight were age of mother at time of conception (younger mother has a lighter baby), prenatal supervision and care, and socioeconomic status of the Negro mother.

Bayley (2) gave the revised forms of the Bayley Scales of mental and motor development to a representative sample of 1409 infants, ages 1 to 15 months. The study was cross-sectional and included white, Negro, and a small sample of Puerto Rican babies. While she found no differences on either scale (mental

or motor) for education of either parent, the number of babies tested at each month was small, varying in number from seven to 37 in each educational subgroup. While no differences were found between the Negroes and whites on the mental scale, the mean motor scores for the Negroes were higher at every age, except 15 months. These differences reached significance at the .01 level of confidence for the months of 3, 4, 5, and 9 months, and at the .05 level for 7 and 12 months. It is difficult to see the rationale for her statement in regard to the Negro-white differences for the motor scale when she says, "the lack of differences for educational subgroups in our sample tends to discredit the environmental explanation for the difference in score, at least for these U.S. children" (2, p. 409). This is especially true in view of the small number of education subgroups which were used for comparison, and for the fact that 19.8 per cent of the Negro fathers and 5 per cent of the mothers did not report their education. The Negro and white groups were also not compared by educational background or socioeconomic status.

There is a fallacy in taking a representative sample when the problem is one of determining whether any differences found are of racial origin. It would appear to this investigator that a comparative study involving infant development should control for the variables affecting development. Many of the previous studies have controlled for one variable, but few have attempted to hold constant several factors affecting development.

B. PURPOSE

The purpose of this study was to compare the development of Negro and white infants by means of the Gesell developmental schedules at 12, 24, and 36 weeks.

The hypothesis was that, when influencing variables were controlled, there would be no differences between Negro and white infant development.

C. METHOD

The Negro and white samples came from Tallahassee, Florida, and environs and were chosen by the following criteria: full-term births, birthweight of at least 5½ pounds, a minimum of four months of maternal prenatal care, and delivery by an obstetrician and in a hospital. An effort was made in the selection of the sample to obtain comparable socioeconomic groups. All babies who had a difficult delivery or whose mothers had toxemia or any disease which might affect the developmental status of the baby were eliminated from the study. Of the 90 mothers of Negro babies and of the 116 white babies who fit the criteria, 51 Negro and 57 white subjects expressed willingness to par-

ticipate in the study. Sixteen of the Negro parents had an education, occupation, and method of salary payment of the father which classified them, for this study, as being in the high socioeconomic group. Similarly 15 of the white sample could be so classified. The remaining sample was categorized, for descriptive purposes, as the low socioeconomic group. The term high and low will be used, hereafter, in reference to them. The total Negro and white samples were then equated on the basis of the combined education of the father

TABLE 1
DESCRIPTION OF GROUPS

Variable	High Negro ^a	High White ^b	Low Negro ^c	Low White ^d
No. of children (M)	2	3	3	3
No. of first births	4	3	8	6
Birth weight (pounds)	7.13	7.26	7.26	7.58
Birth length (inches)	20.51	19.09	20.51	19.94
Mother works	12	5	25	9
Full	9	2	12	6
Part	3	3	13	3
Mother and father live together	All but 1	All	All but 6	All but 2
Mothers' age (M years)	27	29	25	26
Fathers' education (M years)	16	16	10	12
Mothers' education (M years)	15	14.5	10.5	11
Method of payment (% paid)				
Monthly	65	53	15	25
Bimonthly	12	27	32	33
Weekly	23	20	47	36
Hourly	0	0	6	6

^a Males = 8, females = 9.

^b Males = 6, females = 9.

^c Males = 10, females = 24.

^d Males = 22, females = 20.

and mother. From Table 1, it is apparent that the two groups were matched quite well as to socioeconomic background (see Method of Payment, Table 1) and for other factors affecting development: e.g., number of children in the family, age of mother, number of first births, and birthweight and length, as well as subsequent weight and length measurements (Tables 1 and 2), add validity to the fact that the groups were matched quite well as to background and factors influencing growth and development (3, 6, 8). Since the majority of previous investigations have found no sex differences at these early

months, the unequal number of males and females in the Negro group was not considered an influencing variable.

Babies were tested on the Gesell developmental schedules (4) within three days of their 12-week, 24-week, and 36-week birthday. Two trained Gesell testers were assigned at random to both Negro and white samples. For the majority of subjects testing was done in the laboratory, while some of the infants were examined in their homes. If, for any reason, the infant could not be tested at his regular time or within the three-day birthday limit, the test was postponed for four weeks. An infant from the opposite sample and

TABLE 2
MEAN WEIGHT AND HEIGHT OF NEGRO AND WHITE INFANTS

Group	No. of cases	Test period	Weight (pounds)	Length (inches)
Negro	47	12 week	12.84	23.98
White	54		12.79	23.60
Negro	41	24 week	16.96	26.23
White	46		16.96	26.19
Negro	43	36 week	19.83	28.00
White	50		19.66	27.81

from the same socioeconomic background was tested at this time, so that all tests were comparable. They were analyzed, however, with the closest regular test-period group. Data were scored as to the number of items passed in each behavioral area of the Gesell schedule and were totaled for the total Gesell developmental score (12).

D. RESULTS AND DISCUSSION

The Mann-Whitney *U* test was used to determine the significance of the difference between the Negro and white groups. The level of significance was determined for a two-tailed test.

The only statistically significant difference between the two groups was in favor of the Negro infant in motor development at 12 weeks (.009 level of significance). However, the mean scores for the Negro group were higher than the white mean scores for all test areas of development at 12 weeks; after that, the means were comparable.

1. *High Socioeconomic Negro and White Groups*

(Sixteen Negro infants and 15 white babies comprised this sample.) From Table 1, it is evident that these two groups were fairly well matched on the

factors affecting development. When the two groups were compared, significant differences were found, in favor of the Negro infant, in total development and in personal-social behavior at 12 weeks and in motor behavior at 24 weeks (.05 level of significance).

2. *Low Socioeconomic Negro and White Groups*

Thirty-five Negroes and 42 white infants constituted this sample. From Table 1, it is apparent that these two groups also were equated quite well on factors affecting development. The only significant difference found between the two groups was in adaptive behavior at 24 weeks, in favor of the white infant (.05 level of significance).

3. *Other Socioeconomic Group Racial Comparisons*

Tests of significance were computed among all the other groups. Table 3 presents the results of these tests. While there are differences in sample size, such as in the comparisons of the high Negro and high white groups with the low groups, the results bear further scrutiny. The overwhelming superiority of the high Negro group over all other groups, especially the low Negroes, leads one to analyze the high Negro subjects more closely. In the high Negro group, as in the white sample, both parents had a minimum of a high school education, with the exception of one Negro mother who had 11 years of education. The occupations of the Negro group included, among other occupations, three university professors, a high school teacher, and a professional football player. The Negro, in the South, who has had a minimum of a high school education, and who has attained the status of a college or high school teacher rates among the highest echelon in social status and in standard of living. The selective factors operating to enable this individual to reach and to strive for this attainment, no doubt, produce a quite superior individual. The white man and woman who have completed high school and who have gone into teaching and similar professions have had more opportunities to do so, and do not represent as highly selected a group. These factors may help to account for the superiority of the Negro group.

E. SUMMARY

Fifty-one Negro and 57 white babies were tested at 12, 24, and 36 weeks on the Gesell developmental schedules. They were equated for socioeconomic status and for other factors affecting development. When comparisons were made on the Gesell test and its component subdivisions (motor, adaptive, language, and personal-social) the only significant difference found at the

TABLE 3
SIGNIFICANT INTERGROUP DIFFERENCES BY SOCIOECONOMIC CLASS

Class	High White	Low Negro	Low White
High Negro	12 weeks. Negroes better in total development & personal-social area.	12 weeks. High Negroes better in all areas but motor.	12 weeks. Negroes better in all areas.
	24 weeks. Negroes better in motor area.	24 and 36 weeks. High Negroes better in total development, motor, and adaptive behavior.	24 weeks. Negroes better in motor area.
	36 weeks. No differences.		36 weeks. No differences.
High White		12 weeks. No differences.	12 weeks. No differences.
		24 weeks. No differences.	24 weeks. No differences.
		36 weeks. No differences.	36 weeks. No differences.
Low Negro			12 weeks. No differences.
			24 weeks. Whites higher on adaptive area.
			36 weeks. No differences.

three test periods was in motor behavior at 12 weeks, in favor of the Negro infant. This is in accord with other investigations which have found the Negro to have a higher motor quotient at the early months of growth (2, 5, 9). The groups were divided into socioeconomic subgroups and compared for development at the three test periods. The high Negro group was superior to all other groups at various stages of development, and the greatest number of differences occurred between it and the low Negro group. This is at variance with other investigations which have found the low socioeconomic groups to be superior to the higher groups. When the two largest groups were compared—e.g., the low Negro and the low white—the only significant difference found was in favor of the white infant in adaptive behavior at 24 weeks. The results suggest that factors, other than racial, probably account for the few differences found between the two races. The overwhelming superiority of the small group of high Negroes leads one to speculate that the selective factors operating to produce their high educational and socioeconomic status may also be responsible for their superior development.

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RELIABILITY OF GLOBAL OBSERVATIONS OF NEWBORN INFANTS*¹

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A. INTRODUCTION

In the course of an extensive study of the behavior of 215 normal newborn infants, the observer (K. C.) recorded her global impressions of each child in a brief anecdotal summary on the face sheet of the protocol. The protocol contained 186 items covering spontaneous and elicited motor behavior and response to visual, auditory, and social stimulation. The global impressions were written after examinations of the infants which lasted from 25 to 75 minutes each (including such interruptions as occur when newborn infants change state); the impressions represented the distillation of what had been learned about the infants as noted in the more refined and detailed protocols.

The children studied as newborns were again seen at approximately 30 months of age for pediatric and psychological examinations. At this time, without reference to the newborn data, research assistants again rated the personalities of the children in an informal manner. Despite the crudity of these two sets of assessments, there was a better than chance relationship between them.

It seemed worthwhile, therefore, to see whether the behavioral characteristics included in these global impressions could be observed systematically and rated on graphic rating scales. If observers, using brief, simple, and uniform procedures for making the assessments, could reach an adequate level of agreement when rating the same child, further studies to determine the stability of the ratings during the newborn period and their long-range predictive value would be undertaken.

If the rating scales proved dependable when used by persons without extensive experience in making behavioral assessments of newborn infants, and the behavior of the infants rated was shown to be consistent throughout the new-

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born period, the scales would be of assistance to pediatricians, nurses, and others in providing *behavioral* criteria by which to distinguish between infants in good condition and those in need of special care.

In addition to usefulness for practical purposes, ratings of this sort, once reliability and stability have been established, would have a unique advantage for the scientific study of the mother-child relationship from its inception. Since the ratings are based on global impressions, they are similar to those assessments made by the mother herself during her early contacts with her baby. Her impressions of the baby influence her behavior toward him, and he in turn is influenced by her behavior, thus setting into motion a circular interaction between them which is of great importance to both. The mother's early impressions of her baby are, of course, only one influence among many which determine the quality of the mother-child relationship, but one that it beginning to receive the attention it deserves.

This paper reports the results of ratings of 114 healthy newborn infants on six scales: *activity level*, *attention span*, *persistence*, *alertness*, *irritability*, and *social responsiveness*. Two and sometimes three observers rated each infant after watching him in a standard situation for approximately 20 minutes. Analyses have been made to determine the nature and extent of individual differences among the infants on the ratings. The level of agreement between pairs of raters has been determined for each scale. After factor analysis revealed the independent dimensions of the behavioral characteristics included in the ratings, the estimated factor scores of the individual infants were related to other available data concerning their family background and birth.

B. PROCEDURE

1. *Subjects*

The subjects were 114 healthy babies born in New York Hospital. They were observed in the M-1 nursery of the hospital one hour before a scheduled feeding. The nursery consists of units of four infants each, who are cared for by nurses most of the time and taken to their mothers for feedings three times a day. Only full-term infants whose Apgar ratings (1) one minute after birth were 7 or better and who were in good physical condition on the day of observation were considered for inclusion in the study. From among these, infants who were awake and not crying at the beginning of the observation period were selected. If an infant's eyes were open and he fixated briefly on one object or another in the room, and if he was not fussing or crying at that time, he was classified as "awake." Usually he was making slight movements of the face and body and sometimes he was very active.

Fourteen white and five Negro males and the same numbers of females were seen at 1, 2, and 3 days of age, a total of 114 infants. The proportion of Negroes to whites is approximately one to three, representative of the racial composition of the hospital population. At the beginning the infants were randomly chosen from among those who met the basic criteria described above; later only those who also completed the cells of the stratified sample were observed.

Two and sometimes three observers worked together, each rating the same infant independently. Observer 1 (B. D.) observed and rated all the infants, working with one or both of the other observers. Observer 2 (B. A.) rated 98 infants, and observer 3 (E. G.) rated 48 infants. All three observers saw 32 infants together; observers 1 and 2 saw 66 infants together; and observers 1 and 3 saw 16 infants together. Stratification of subjects by age, sex, and race was closely approximated in all combinations of raters.

2. *Procedures for Making the Observations*

The observers were psychologists who were relatively new staff members with very little experience in the observation of newborn infants. The infants were observed at 8 A.M., at 12 noon, or at 4 P.M., one hour before a scheduled feeding. The procedures upon which the observations were based are as follows:

The infants were observed in their nursery units. Each infant selected for observation was removed from his crib, unswaddled, and his clothing changed as necessary. A check was made to be sure he was not physically uncomfortable before the observation was begun: that is, that he was not having difficulty breathing, regurgitating, or hiccoughing, and that his abdomen was not distended. Observations were interrupted during defecation and micturition.

The selected infant was placed on four thicknesses of smooth blanket on his own crib table, with his head to the left of the observer who was handling him. Since most infants spontaneously roll to the right (8), the observers could see his face in this position.³ If he persistently rolled to the left during this initial period of the observation, his position was changed so that his head was at the opposite end of the table. Before the beginning of the observation proper, a check was made to be sure he met the criterion of being awake and the observation was continued only while he remained awake.

Observer 1, who rated all the infants, then bent over him and observed him for one minute. Next she moved about to see if he made an attempt to follow her with his eyes. She then bent over him again and spoke to him, noting

³ A moving picture study in progress at New York Hospital confirms Gesell's finding that most very young infants prefer to lie on the right side.

whether he fixated upon her, changed facial expression, or changed his general bodily activity. Next she dangled a red embroidery hoop⁴ from a string approximately 12 inches from the infant's head and in his line of vision, to see if he fixated upon it. The hoop was then moved down in a horizontal arc to his right or left, depending upon the position in which he was lying, to see to what extent he followed it with his eyes (and sometimes with his head and body). This procedure was repeated at least twice, and more often if the infant's response was in doubt. The distance of the hoop from the infant's eyes was varied somewhat because not all infants fixate at the same point (19).

Then the observer shook a rattle and subsequently rang a bell⁴ approximately 12 inches from the infant's head and beyond his line of vision. The nature and strength of the response as well as the length of time the infant seemed to be reacting to sound were noted.

Next, if he was sucking his fingers they were removed from his mouth to see whether he would return to this activity; if he was not sucking his fingers, they were placed in his mouth, to see whether he accepted this change or withdrew them.

Observer 1 then picked him up and held him to her shoulder, with his head high enough so that the other observer(s) could see how he adjusted to this change in position. Then the infant was shifted to her arms, and she swayed gently and spoke to him in soft tones. This procedure was repeated at the end of the observation with one of the other observers handling the infant, to give each observer an equal opportunity to watch the infant's response to these shifts in position.

The infant was then placed on the side opposite to that to which he had rolled earlier, and it was observed whether he remained where placed or rolled back to his former position.

If at any time the infant appeared to become drowsy or began to fuss or cry, the observer who was handling him picked him up, talked to him, and played with him until he returned to the state defined as awake, and was no longer in observable distress. As is well known, it is not possible to equate the physiological states of newborn infants by observational methods (7). In this study an effort was made to observe the infant's behavior under optimal conditions when awake and not in distress, and also, insofar as possible, to observe all infants under comparable conditions.

⁴ These test objects have been used in many infant scales, those of Gesell, Cattell, and others.

3. *The Rating Scales*

The six scales, derived from the anecdotal records included in the more extensive study in progress, are described as follows:

Activity level was rated on the basis of the proportion of the observation period during which the infant engaged in observable movements, segmental or involving the whole body, and the vigor, rapidity, and definiteness of the movements.

Attention span was defined as the length of time the infant sustained a specific response to an identifiable stimulus; judgments were based on the length of time the infant fixated on, or followed with his eyes, an object or person, and to a lesser degree the length of time he attended to an auditory stimulus.

Persistence was rated on the basis of the infant's response to having his fingers removed from or placed in his mouth, and his response to the imposed shifts in position; these responses were considered indications of the strength of his tendency to continue an ongoing activity or to resist change.

Alertness was judged on the basis of the infant's apparent awareness of his surroundings, and his response to various specific stimulations, as demonstrated by changes in facial expression and in bodily activity. Examples are a startle reaction to the sound of the bell or a decrease in general bodily activity in response to a soft voice. (Duration of response was not taken into account in making this rating, as this aspect of infant behavior was included in the rating of attention span.)

Irritability was judged on the basis of the frequency, duration, and intensity of fussing or crying which did not appear to be related to identifiable physical discomfort, and which persisted despite efforts to quiet or distract the infant during the observation period.

Social responsiveness was rated on the basis of the frequency, duration, and intensity of the infant's responses to the observers, depending on visual, auditory, and tactual stimulation, and demonstrated by a change in facial expression, bodily movements, and, occasionally, by vocalization.

Each scale is a graphic rating scale (11), with five descriptions placed along a 200 millimeter line. The scales were mimeographed on separate sheets of paper and assembled in a standard sequence, in the same order as described above. General instructions for making the ratings were given on each scale in addition to the descriptions along the line. The raters were free to place their ratings anywhere along the line they chose, from one end of the con-

tinum to the other; the descriptions were meant to serve as guide posts only. After the infant was returned to his crib, each observer rated him on each of the six scales before discussing his behavior with the others.

A numerical score was later given to each rating by dividing each scale of 200 millimeters into 20 units of 10 millimeters or one centimeter, and assigning the value of the nearest point to the rating. The possible range of ratings on each scale was, therefore, 0 to 20, with 20 representing the raters' conception of the highest degree, 10 the average, and 0 the least, of the behavioral characteristic rated.

C. RESULTS

1. *Distribution of Ratings*

Table 1 gives the means and standard deviations of the ratings on each scale. The means do not differ appreciably from the predetermined midpoints on five of the six scales. The tendency for all raters to place the average infant

TABLE 1
MEANS AND STANDARD DEVIATIONS OF THE RATINGS

Scale	Rater 1 (114 ratings)		Rater 2 (98 ratings)		Rater 3 (48 ratings)	
	Mean	SD	Mean	SD	Mean	SD
Activity level	10.4	4.2	9.7	4.4	9.7	3.7
Attention span	10.3	4.4	10.4	4.7	10.2	5.5
Persistence	11.8	4.2	12.4	4.6	11.7	3.8
Alertness	11.5	4.0	12.1	4.6	11.6	4.0
Irritability	7.4	4.8	7.1	5.3	9.2	5.2
Social responsiveness	10.8	4.8	11.3	5.2	11.9	5.0

below the predetermined midpoint on the *irritability* scale may have several explanations. The lower means on this scale may result from the exclusion of infants from the study who were fussing or crying at the beginning of an observation period. Also, irritability may not be normally distributed among normal healthy infants, especially when extensive efforts have been made to see that they are physically comfortable. Under these conditions skewing to the left would be expected, with the means of the ratings lower than the predetermined midpoint, since the latter is based on the assumption of normal distribution of the characteristic to be rated.

The magnitude of the deviations suggests that the raters used the major portion of each scale: that is, that the ratings were spread out along the continuum from the least to the most of each characteristic as defined. The

similarity among means and standard deviations of all raters on each characteristic further suggests that the raters were using essentially the same frame of reference in making their judgments.

2. Interrater Reliability

Table 2 gives the product-moment correlation coefficients between pairs of raters on each scale, indicating their level of agreement. These correlations are, in effect, estimates of the reliability of the ratings by any one judge. Since a more important issue for the purposes of this study is the reliability of judgments of one infant by two or more judges, reliability coefficients were also

TABLE 2
PRODUCT-MOMENT CORRELATION COEFFICIENTS FOR RATERS ON SIX SCALES
(Reliability estimates per rater)

Raters	Activity level	Attention span	Persistence	Alertness	Irritability	Social responsiveness
1 and 2	.55	.83	.54	.80	.83	.83
1 and 3	.52	.84	.53	.75	.78	.87
2 and 3	.54	.87	.58	.85	.80	.77

TABLE 3
RELIABILITY COEFFICIENTS FOR AVERAGES OF TWO RATERS ON SIX SCALES
(Spearman-Brown)

Raters	Activity level	Attention span	Persistence	Alertness	Irritability	Social responsiveness
1 and 2	.71	.91	.70	.89	.91	.91
1 and 3	.68	.91	.69	.86	.88	.93
2 and 3	.70	.93	.73	.92	.89	.86

computed for the average of two judges, according to the Spearman-Brown formula. These are presented in Table 3. The coefficients of Table 3 are underestimates to some degree, since 32 infants were rated by three observers.

The reliabilities of pairs of raters (as given in Table 3) on four of the scales, *attention span*, *alertness*, *irritability*, and *social responsiveness*, are adequate for the assessment of individual infants; the other scales would be suitable in their present form for large-scale research only. An attempt will be made to improve the reliability of the two remaining scales, *activity level* and *persistence*, by changes in procedures of observation, and by more clearly defining the behavioral characteristics to be rated.

These correlations take into account only the pattern or order of scores, not the differences among raters in the means and standard deviations of their ratings on any one scale (given in Table 1). Table 4 presents both the product-

moment correlation coefficients and the intraclass reliabilities of the ratings on each scale computed so as to treat systematic differences among judges as errors (13, p. 13). The product-moment correlation coefficients are not appreciably higher than the intraclass reliability coefficients. Hence, there is no need to correct or differentially weight the scores of any rater before combining the ratings to obtain a composite or average score for each child.

TABLE 4
PRODUCT-MOMENT AND INTRACLAS RELIABILITY COEFFICIENTS PER RATER
AND FOR POOLED RATERS

Scale	Per Rater		Raters Pooled	
	Intraclass	Product-moment	Intraclass	Product-moment
Activity level	.54	.54		
Attention span	.83	.85	.73	.73
Persistence	.53	.55	.92	.93
Alertness	.79	.80	.72	.74
Irritability	.79	.80	.89	.90
Social respon- siveness			.90	.90
	.82	.82	.91	.91

3. *Factor Analysis of the Infants' Scores*

To determine the number and nature of independent dimensions of behavior rated on the six scales, a factor analysis was performed, using the average score of the judges for each infant on each scale.⁵ Factor scores for individual infants were obtained by adding the averaged ratings for the three scales in each factor. Table 5 presents the composition and loadings of the two rotated factors revealed by this analysis.

The factor loadings indicate that the infants were actually rated along two dimensions rather than six. Factor 1 includes the scores on *attention span*, *alertness*, and *social responsiveness*. Factor 2 includes the scores on *activity level*, *persistence*, and *irritability*.

Since the correlations among the ratings on the three scales which make up Factor 1 are very high, any one of the scales might be used for rating this dimension. However, to combine into a new scale the salient points from the descriptions of all three scales composing this factor, thus enlarging the sample of behavior to be observed for purposes of making ratings, would further improve the reliability of assessment of this dimension, might increase its

⁵ With ones in the diagonals, four principal components were extracted, whose roots were successively 2.75, 1.44, .16, and .04. Obviously there were only two substantial dimensions and the first two factors were rotated by the Varimax method (14).

stability during the newborn period, and therefore maximize the likelihood of its having predictive value.

The psychological meaning of the two independent dimensions or factors included in the ratings will be discussed in the final section of this report. The only scale among those comprising Factor 2 which has any appreciable correlation with Factor 1 ($-.29$) is the *irritability* scale, indicating that irritable babies tended to score poorly on ratings of responsiveness to sensory stimulation.

Unlike the score on the scales comprising Factor 1, as reflected by the lower loadings, the correlations among the three scales of Factor 2, although significantly related, are not so high as to make the scales interchangeable, or to suggest that combining them into a single rating would be advantageous.

TABLE 5
COMPOSITION OF TWO FACTORS AND FACTOR LOADINGS OF THE SIX RATING SCALES

Scale	Factor 1	Factor 2
Alertness	.94	— .07
Social responsiveness	.93	— .13
Attention span	.92	.03
Activity level	.03	.76
Persistence	.05	.72
Irritability	— .29	.62

4. *The Relationship of the Scores to Other Available Data*

The factor scores of each infant were correlated with 21 items of information from the hospital records and two from the procedures of the study. All correlations are product moment r 's; when the correlation of a factor score with a dichotomous item is given, the correlation is a point biserial r . These items are:

Parents: mother's age, father's age, parents' religion, parents' financial status as rated by the hospital, mother's marital status.

Mother's medical history: parity, gravidity, previous fetal loss.

Complications of pregnancy: preeclampsia, anemia, bleeding.

Labor and delivery: length of first stage, length of second stage, amount of medication, type of delivery (spontaneous or assisted).

Infants: estimated gestational age, birth weight, Apgar score, age (1, 2, or 3 days), race (Negro or white), and sex.

Study procedures: observation at 8 A.M., 12 noon, or 4 P.M. and whether the observation and rating was made early or late in the study.

The scores of the individual infants on Factor 1 correlated significantly ($r = .28$, $p < .01$) with estimated gestational age (expected date of confine-

ment, EDC, plus or minus birth date). Ninety-four infants were born within 15 days of EDC; 10 were 16-45 days overdue, and eight were 16-45 days early according to this calculation. Birth weight did not correlate significantly with Factor 1 ($r = .02$). EDC is generally regarded as a very unreliable measure. However, within the range of presumably full-term infants (2500 grams or more), EDC may be a better measure of maturity than birth weight. Or, Factor 1 may measure something which is not related to maturity. It remains to be seen, of course, whether the responsiveness rated is a lasting advantage to the infants who scored high on Factor 1 during the newborn period.

When Factor 1 was correlated with the time of day at which infants were observed, each time of day was treated dichotomously. The infants seen in the late afternoon had high scores on Factor 1 ($r = .20, p < .05$); those seen at noon had low scores on Factor 1 ($r = -.23, p < .05$). The scores of those seen in the morning were not significantly related to the time of observation ($r = .05$). These differences in responsiveness at different times of day suggest that the infant's experiences in the hours immediately preceding the observations may influence his behavior, and that, in future work, time of day should be controlled as well as the relationship of the observation period to the feeding schedule. There may be an optimal amount of prestimulation which encourages responsiveness in the infants, with more prestimulation producing habituation or fatigue, and less making them more difficult to arouse. At New York Hospital, stimulation (noise and handling) is at a minimum during the night, at a maximum during the morning, and midway between these extremes in the afternoon.

Factor 2 did not correlate significantly with any data from the hospital records or with study procedures. If EDC is a measure of maturity within the normal range of full-term infants, the behavior rated on the scales of Factor 2 is not related to maturity.

The "normality" of the subjects of the study probably explains the lack of relationship between the infants' factor scores and most of the other data. All the infants were born spontaneously or with the assistance of low forceps only; they were in good condition at birth as indicated by their Apgar ratings. None of the mothers had massive dosages of medication during labor or delivery. The adverse factors in the records were of such mild degree that they might be expected to have less effect upon the infants' behavior than the interaction between genetic factors and prenatal environment.

Several intercorrelations among data from the hospital records, not directly relevant to the results of the study, nevertheless provide collateral evidence of the validity of the information. Parity was positively correlated with birth

weight ($r = .33, p < .01$), and negatively correlated with delivery time ($r = .28, p < .01$), medication ($r = .37, p < .01$), and frequency of assisted deliveries ($r = .32, p < .01$). Financial status was correlated with the absence of complications ($r = .28, p < .01$). These relationships are to be expected on the basis of numerous previous investigations.

Analysis of variance was used supplementarily to determine whether sex, race, or the age of the infant on the day of observation influenced the factor scores. The results were negative for each of these variables (as found in the correlations) and for the interactions among them.

D. DISCUSSION

The results of this study show useful variation among infants; this finding adds to the literature of empirically demonstrated individual differences among newborns (4, 18, 19, 20). The extent to which individual infants may be rated similarly on successive days has not been dealt with in the present study. However, several recent investigations have included reports of consistent behavior from day to day in newborn infants (4, 5, 17, 19).

On four of the six scales interrater reliabilities were very high, and no correction for rater bias was necessary. It appears, therefore, that raters without extensive experience in observing newborn infants can achieve a high level of dependability provided (a) the characteristics rated are clearly defined; and (b) uniform procedures are used for making the observations: that is, the ratings are based on the same sample of behavior. No difference was found between the ratings made early and late in the study, further evidence that extensive experience with newborn infants is not necessary if the foregoing conditions are met.

Failure to reach acceptable levels of interrater reliabilities for use in individual assessment of the remaining two scales has at least two possible explanations: poor definition of the behavior to be rated, or selection of behavior characteristics which cannot be reliably observed and rated by this method. Further study should make it clear whether one or both of these explanations hold, or whether other explanations must be sought.

Precise comparisons of the results with the interrater reliabilities reported by other investigators of newborn behavior are not possible. The characteristics studied, even when similarly named, are differently defined. Different methods of making the ratings have been used, and, of course, subjects and raters vary from one study to another.

The higher interrater reliabilities of the present study in comparison with the averages reported for two judges by Haar, Welkowitz, Blau, and Cohen

(12) may be due to a combination of several of these variations. In the Haar study, a questionnaire was used, and nurses who had cared for premature infants for periods of 11 to 71 days were the raters.

Graham, Matarazzo, and Caldwell (9) reported interscorer agreement on scales of Maturation, Vision, Irritability, and Tension for a small number of neonates, some of whom were traumatized. The scale most comparable to those of Factor 1 in the present study was the Vision Scale, on which an r of .90 on 17 normal and four traumatized infants was obtained. (Irritability results were reported in percentage of agreement only, and thus cannot be compared with the results of the present study). Rosenblith and Lipsitt (21), using the Graham scales, reported appreciably lower reliabilities on 23 normal infants. An r of .77 was obtained on the Vision Scale.⁶ Rosenblith and Lipsitt suggest that the inclusion by Graham of traumatized infants may account for the higher interscorer agreements in the original study. In addition they mention that the lower correlations found upon replication may result from the raters' lack of training in using the Graham scales, and the need for further codification of the behavior covered by the scales.

Several studies in which ratings were based on filmed time-samples of newborn behavior should be mentioned. An extensive study of spontaneous and elicited behavior of 32 newborn infants was made by Bell (3). The data consisted of five- to eight-second filmed sequences of behavior, taken at 15-minute intervals during a period of three hours between feedings. Filming was commenced when the infants were approximately 96 hours of age. Two judges rated 40 variables on seven-point scales, or, in some instances, counted the occurrence of certain kinds of behavior. The Spearman-Brown formula applied to product-moment correlations between the ratings of the two judges yielded values ranging from .60 to 1.00, with a median value of .85.

Kessen, Williams, and Williams (17) and Hendry and Kessen (16) have reported interscorer correlations for several measures of oral behavior and tension obtained on several small groups of healthy newborn infants. In the 1961 study the correlations were .90 and .96 when check lists were used, .93 and .99 for mechanical recording, and .96 for measurements made from filmed data. The interscorer reliabilities for filmed data in the 1964 study were .96 and .99.

When filmed behavior is the data upon which ratings are based and a small number of carefully defined behavior characteristics are rated, interrater reliability should reach almost perfect agreement. When a more extensive study

⁶ In neither of these studies has the use of the Spearman-Brown formula been reported.

of newborn behavior is attempted, such as that of Bell (3), one may expect considerable variation in the level of interrater agreement attained on different types of behavior even from filmed data. There are probably some characteristics that can be dependably rated only when motion pictures permit repeated viewing. Still others may require even more complete instrumentation. From the experience of the present investigators, the results of Bell (3) and of Kessen *et al.* (17), and of the earlier studies mentioned by Pratt (19), *activity level* appears to be of the latter kind.

There are, however, practical and scientific purposes for which motion pictures and other instrumentation are not appropriate or are too costly. The successful attainment of high interrater reliabilities in the present study suggests that properly instructed raters, working in pairs, can observe and rate certain characteristics of neonates dependably, and thus for the rating of some types of behavior the use of more elaborate methods is not required.

Two limitations of ratings should be mentioned in connection with the results of this study: *halo effect* and the *logical error* (11). The design of the study did not entirely eliminate the possibility that the raters were influenced on later ratings in the series by those they had already made. However, it should be noted that the scales of Factor 1 were in positions 2, 4, and 6 in the series, and consequently those of Factor 2 were in positions 1, 3, and 5. The *social responsiveness* scale was placed last in the sequence because it was thought that the infants' responsiveness to the observer-raters might exert an effect on any ratings which followed.

The logical error can never be entirely eliminated from any study that depends on verbal descriptions of personality. People do have preconceptions concerning the characteristics which should go together, and which should, therefore, be found in the same child. It is of interest, however, that an informal record of the prestudy ideas of the raters failed to match the results of the factor analysis study very closely. Rater 1 thought that scales 3 and 5 (*persistence* and *irritability*) would be independent. Rater 2 thought that 2 and 4 would be relatively related but independent of 6 (*social responsiveness*), and negatively related to 5. Rater 3 thought that 2, 4, and 6 would be relatively independent, that 1 would be positively related to 4, 5, and 6, negatively related to 3, and that 3 and 5 would be negatively related.

In Table 5 the actual interrelationships were listed; the presuppositions match the results of the factor analysis less than half the time, and the three raters did not agree among themselves on the relationships actually found between any pair of scales.

Factor analysis, including rotation, may be undertaken for two major pur-

poses: to reduce the number of variables required in a particular study, and to sharpen hypotheses concerning the phenomena under investigation (11). In this study, the communalities among the ratings on the scales of *attention span*, *alertness*, and *social responsiveness* are so large that one improved scale can serve in the place of these three in future work. The communalities among the scales of the second factor are significant but not very large, partly due to their relatively lower reliability. As mentioned above, two of the scales must be improved before they can be used for individual assessment.

Tentative identification of the two factors revealed in this study may provide better working hypotheses for further research in this area. Factor 1, comprised of *attention span*, *alertness*, and *social responsiveness*, appears to cover responsiveness to sensory stimulation in general, whether the source of the stimulation is the surroundings, a specific object, or a person, and to include responsiveness to visual, auditory, tactual, and kinesthetic stimulation. Attention and sensory responsiveness are requirements for perception and learning (15); therefore Factor 1 has been designated *precognition*.

Factor 2, comprised of *activity level*, *persistence*, and *irritability*, appears to measure style of responding to internal or external stimulation. For reasons largely unknown to the observer, the infant is active or quiet; he persists in an activity (or resists change), or he accepts change imposed upon him without observable disturbance; and he exhibits a high or low tolerance for stimulation as compared with other newborn infants. This factor has been tentatively designated a factor of *temperament*. Except for the fact that irritable babies responded poorly to sensory stimulation in this study, *precognition* and *temperament* were not related.

Psychologists have made numerous attempts to predict outcome from infant behavior using molecular approaches (2, 6, 9). To date the results of these efforts have been disappointing. There may be, therefore, merit in further exploration of a global approach in future efforts to predict outcome from neonatal behavior.

E. SUMMARY

Graphic rating scales of six behavioral characteristics were used by two and sometimes three observers of newborn infants. The ratings were made after observing each of 114 infants, 1 to 3 days old, for a 20-minute period during which specified procedures were followed. Interrater reliability was high on four scales; two must be improved before they can be used for individual assessment. Factor analysis of the ratings revealed two independent dimensions of behavior; these have been tentatively identified, related to background variables, and discussed.

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OBSERVATIONS ON THE ORIGINS AND CURRENT STATUS OF THE EGO ASSERTIVE PERSONALITY FACTOR, U. I. 16*¹

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A. IMPORTANCE OF THE U.I. 16 PATTERN

The multivariate model of personality has moved beyond the early stages of taxonomic description culminating in the work of Hundleby, Pawlik, and Cattell (32), to a phase of factor explication and hypothetico-deductive experimentation (13). At the present stage of consolidation in multivariate personality theory, Cattell has suggested [in Wepman and Heine (45, p. 423)] that the score of replicated factors now known constitute "twenty patterns in search of a theory" and has proposed that focusing of research by concerted investigations on individual factors would yield maximum progress in "personality sphere" research.

Frequently, criticism has been leveled toward the role of factor analytic tools in personality theory. Such old saws as "you only get out of factor analysis what you put into it," and "factor analysis only *gives* a classification schema," epitomize the superficial and puerile attempts of some to dismiss quantitative procedures from the domain of personology. On the contrary, studies of personality factors uncovered through multivariate tools, and designated by a Universal Index (U.I.) notation in the Compendium series (19) yield fresh insights into perennial problems. For example, the work of Cattell and Scheier (18) on U.I. 24, the anxiety factor, and Cattell's (9) explication of U.I. 28, the "authoritarian" (super ego asthenia) personality factor, have demanded a re-examination of these clinical concepts in light of quantitative advancements. Recently, additional studies have been directed toward U. I. 22, cortertia (41), and the exuberance-suppressibility dimension (37), U.I. 21. The scope of the present paper is an investigation of what has tentatively been called the ego assertive dimension, technically labeled assertive ego *vs.* bound disciplined ego, and permanently entered as U.I. 16 in the Compendium series (19).

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The factor we are focussing upon in this article has the unquestionable importance associated with being the largest single contribution (apart from intelligence) to the personality sphere. It should be noted that the ability indexing ends at U.I. 15, so the index U.I. 16 connotes that it is the largest contributor in mean variance of all known personality factors. Accumulated evidence from assembling the factor patterns of successive experiments indicates that individuals high on the ego assertive factor (U.I. 16+) are best described by four kinds of attributes: (a) faster speed and tempo of action, (b) higher self-assertiveness in competitive situations, (c) less impairment of performance by frustration, and, possibly, (d) "strong" body physique. The individual at the low end of this continuum, designated U.I. 16 (—), possesses the converse of these characteristics. A pattern of this kind has been intermittently and vaguely "spotted" at the prefactorial or largely literary and clinical level for a long time and has been variously called "ego strength," "inferiority overcompensation," "narcissism," etc. It has also undoubtedly at times been confused with both the real factors extraversion-introversion (U.I. 32) and exuberance-restraint (U.I. 21).

To make a brief digression into these earlier sightings of the dimension, we should probably begin with Theophrastus and continue through the literary characterologists. However, as often happens, an unsuspected appendage has been added by the purely literary discussions of U.I. 16: namely, the association of ebullience, physical prowess, and a "will to power" with high Ego Assertiveness, U.I. 16+ (as illustrated by literary characters, such as Tam-burlaine, Richard III, Antigone, and Theseus) and the linkage of dourness and depression with low Ego Assertiveness (as illustrated by Chekhov's Lyubov Andreyevna, O'Neill's "Father" in *Long Days Journey Into Night*, and T. S. Elliot's Prufrock in "Love Song of J. Alfred Prufrock").

An important outcome of the multivariate approach to personality is the stripping away of literary appendages and allusions and the revealing of an experimentally solid, meaningful dimension described in bold relief in operational terms—and measurable. The purpose of the present paper is to explicate U.I. 16; to marshal the evidence for its existence, its relationship to physiologic, state, and other personality factors; and to suggest several hypotheses for the developmental pattern of "ego-assertiveness" which personologists can now put to experiment.

B. PRINCIPLES AND METHODOLOGY OF SOURCE TRAIT INTERPRETATION

A general set of principles is rapidly evolving for the formulation of hypotheses to interpret factors, and for an iterative cycle of inductive-hypothetico-

deductive experiment to test these hypotheses. A core of principles applicable to recognizing and interpreting factors at the initial statistical level has been set out by Cattell (9) and Meredith (37). The following list of required steps extends these into further experimental possibilities:

1. To examine the "goodness," in terms of the hyperplane count and statistical significance, of the simple structure arrived at by "blind," independent rotation in several related studies. The 12 studies in Table 1 were "blind" and independent, and reached hyperplane counts averaging approximately 59-60 per cent (3).

2. To check, by a significance of matching test, the agreement of the independently achieved factor patterns across studies: e.g., by employing Burt's congruence coefficient (30), the nonparametric salient similarity index (14), or the configurative matching method (11).

3. To consider hypotheses first as suggested by the leading pattern itself: i.e., by the nature of the actual variables which (a) load highly positively, (b) highly negatively, and (c) do not load, though included in the studies.

4. To analyze extension variables and their factor pattern which serve as a powerful adjunct to the factor interpretation problem (24). Not only the variables that are in the factorization are crucial, but also those variables that are correlated with the included variables.

5. To determine the rank order of general variance of the factor among factors, and whether it is found also, and with what modifications at other ages and in other populations.

6. To inspect the correlations of the factor with questionnaire (Q) or life rating (L) factors based on time-sampled behavioral observations or teacher judgments (5).

7. To examine the nature-nurture ratios, both between families and within families. For it would be fruitless to devote much time to a temperamental theory when this initial "sorting" points to an environmental explanation, or to go far with learning theories if the evidence points clearly to a predominantly hereditary explanation (10, 21).

8. To examine age trends in the factor score.

9. To look at the second order structure among objective test factors, in which the given factor might be involved.

10. To look for any evidence of state factors (P- or Incremental R-technique) akin to the trait in pattern (38).

11. To examine correlations with (or group differences on) particular life criteria: e.g., school success, clinical problems, delinquency, etc.

TABLE 1
SALIENT TEST MARKERS FOR U.I. 16: DEVELOPED (UNBOUND, ASSERTIVE) EGO vs.
DISCIPLINED (BOUND, UNASSERTIVE) EGO

Test title	Compendium ^a designation	No. of studies	Average ^b loading
Mazes (Pencil): faster speed and higher accuracy ("goodness" of performance)	MI 379 (T42)	2	+62
Line Length Judgment: faster speed	MI 309 (T45)	3	+58
Reading Tempo and Memory for Interesting Material: faster tempo	MI 278 (T6)	4	+57
Reading Speed Under Frustration: faster rate of reading (delayed feedback)	MI 511 (T299)	4	+57
Reading Speed Under Frustration: faster rate of reading to oneself	MI 516 (T299)	4	+57
Idiotic Imagery: shorter duration of images	MI 79 (T234)	1	+55
Ideomotor Tempo: faster tempo	MI 9 (T50)	4	+49
Tapping: faster tempo	MI 268 (T136)	3	+49
Aspiration Level in Coding: less excess of aspiration over performance in coding	MI 101a (T17)	1	+46
Mazes (Pencil): less excess of aspiration over performance	MI 101b (T42)	1	+46
Mazes (Pencil): higher speed on difficult relative to easy mazes	MI 237 (T42)	1	+46
Cancellation of Circles: more items correct	MI 375 (T280)	1	+45
Mazes (Pencil): more accuracy	MI 234 (T42)	3	+44
Hesitancy: greater accuracy in judgment of size	MI 378 (T62)	1	+44
Heartogram: greater increase in heart rate after startle	MI 84a (T314)	4	+43
Pulse Rate Under Shock: greater increase with stress	MI 84b (T108)	4	+43
Likes and Dislikes: slower speed in checking things disliked relative to things liked	MI 839 (T79)	1	+39
Word Judgment: less influence of frustration on judgment	MI 61 (T357)	1	+39
Bodily dimensions: greater length and girth of bones (more ectomorph)	MI 487 (T257)	3	+36
Memory for Free Associations: higher total number of words remembered	MI 716 (T65)	1	+36
Tapping: faster speed	MI 264 (T136)	1	+35
Leg Persistence: little decrease in persistence over time	MI 346 (T230)	1	+35
Likes and Dislikes: faster speed checking things disliked	MI 1146 (T79)	1	+35
Highbrow Tastes: more highbrow tastes	MI 117 (T27)	5	+34
Achievement Satisfaction: less masculinity of interests	MI 63 (T271)	1	+31
Reaction Times: faster reaction times under complex conditions	MI 335 (T122)	1	+31
Cursive Miniature Situations: higher total score	MI 143 (T121)	5	+30
Poetic Appropriateness: higher score	MI 118 (T259)	3	+29
Dot Connection: Competitiveness: fast speed	MI 272 (T188)	1	+29

TABLE 1 (continued)

Test title	Compendium ^a designation	No. of studies	Average ^b loading
Letter and Number Comparison: faster speed (numbers)	MI 308 (T44)	2	+29
Arm Circling: faster tempo	MI 270 (T138)	8	+28
Reading Preferences: fewer questionable reading preferences	MI 21 (T5)	12	+26
Letter and Number Comparison: faster speed (letters)	MI 307a (T44)	4	+26
	MI 307b (T185)	4	+26
	MI 244 (T361)	2	+24
Hard Headed Decisiveness: faster speed of judgment			
Drawings (Unstructured): greater number of objects seen in unstructured drawings	MI 282 (T20)	7	+24
Treadmill: less reluctance to enter fear situation	MI 492 (T125)	2	+24
Mazes: Blind Stylus: greater distance covered	MI 82 (T129)	5	+23
Hidden Pictures: more hidden objects seen (not scored for accuracy)	MI 171 (T33)	3	+23
Goal Seeking: Long Term Goals (Questions): greater belief in attainability of goals			
Opinion Inventory X: higher personal relative to institutional values	MI 212 (T39)	2	+23
Design Evaluation Speed: faster speed of evaluative judgment	MI 125a (T9)	3	+22
Cattell Motivation Test: lower self sentiment (greater reluctance to damage self respect)	MI 382 (T150)	2	+22
	MI 933b	2	+22
	MI 15 (T121)	8	+21
Cursive Miniature Situations: more use of circles			
Backward Writing: Motor Perceptual Rigidity: higher ratio of final to initial novel performance	MI 24a (T1)	5	+21
Reading Backwards: higher final relative to initial novel performance	MI 24c (T194)	5	+21
Cursive Miniature Situations: higher score under fast relative to slow conditions			
Cursive Miniature Situations: faster speed of decision	MI 24d (T121)	5	+21
Drawings: Expansiveness of Copying: larger size	MI 153 (T121)	3	+21
Aphorism Acceptance: less acceptance of obvious aphorisms	MI 247a (T117)	3	+21
Reading Speed Under Frustration: lower articulatory efficiency (normal reading)	MI 150 (T18)	2	+21
	MI 509 (T299)	2	+20

^a In the Cattell and Warburton Compendium Series (19), the T symbol designates a specific test, while a Master Index (MI) symbol specifies a scored variable on the test. Any test may have a number of MI variables, some of which may load several factors in the "personality sphere."

^b The amount listed as the loadings, is the *mean loading* of results from different studies. The number given in parentheses following the mean loading indicates the number of separate studies in which the variable was used. The pattern of loadings originally contained several negative loadings. For ease of reading all negative values have been reflected and at the same time the verbal descriptions have also been reflected, i.e., all signs are now consistent. For example, MI. 335 was originally "Length of reaction time" and was negatively loaded. It now reads "Higher speed of reaction time," and is positive.

12. To seek evidence of effects of manipulative experiments upon factor scores (applications to experimental contexts).
13. To study closely, in a clinical sense, the behavior of *individuals* known to be extreme high or low on the factor measurement.

C. NATURE OF THE FACTOR PATTERN

1. *Fast Speed and Tempo*

In the psychometric pattern of U.I. 16, we find a total of 21 variables that all indicate fast tempo (i.e., fast "natural" rate of performance) and fast speed (i.e., fast top rate of performance). These encompass a wide range, from tempo of physical movements (M.I. 270: fast arm-shoulder tempo; M.I. 269: fast leg-circling tempo), through psychomotor and "ideomotor" speed and tempo (M.I. 268: fast tapping tempo; M.I. 264: fast tapping speed; M.I. 272: fast speed of dotting; M.I. 9: fast ideomotor speed; M. I. 335: fast reaction time under complex instructions), speed on simple motor tasks (M.I. 82: fast speed on finger maze; M.I. 379: fast pencil maze performance; M.I. 340: fast speed of repetitive form board performance; M.I. 278 and M.I. 511: fast tempo or reading), to perceptual speed (M.I. 307: fast speed of letter comparison; M.I. 308: fast speed of number comparison; M.I. 309: fast speed of line judgment; M.I. 7: fast speed of perceptual Gestalt completion) and speed of judgment and decision (M.I. 244: fast speed of judgment—"hard-headed realism" test; M.I. 378: fast speed and high accuracy in quantity judgments; M.I. 382: fast speed of evaluative judgment; M.I. 153: fast speed of decision—Cursive Miniature Situation).

Since "fast speed" in the U.I. 16 person is obviously not any *one* of these, and since it shows most in competitive and exploratory situations, we may tentatively ask if it may not be a motivational component in all speed and performance situations—rather than a primary characteristic in itself. Moreover, its extension over a broad range of widely different performances (from simple physical movements of M.I. 269 and M.I. 270 to judgments on complex social issues, M.I. 244) precludes interpretation in terms of well known "ability" speed factors alone. "Speed" as an individual difference factor has been endlessly pursued in various psychological domains of research. The picture has remained completely confused because of lack of perspective in methodology, and of experimental designs which could give perspective. Cattell (through a personal communication) has suggested that broadly four concepts are necessary—(a) a variety of speeds associated with abilities (31) from general intelligence downwards, (b) speed in simple activities, which is a

function of motivation, (c) a temperamental tempo factor or factors, and (d) a speed in production appearing notably in fluency. The third and fourth can be seen in U.I. 22, cortertia, with its high neural activations quality, and U.I. 21, exuberance, which seems to be the temperamental source trait behind the supposed ability factors of fluency (28, 29).

2. *High Self-Assertiveness*

Cumulative research experience shows high self-assertion to be associated with fast speed of decisions, high endurance, less fluctuation of performance quality over time, and less readiness to change one's opinion when presented with the opinion of an "authority." Fast speed of judgment on complex social issues decision (M.I. 153) has already been mentioned as marking U. I. 16. In addition, this factor correlates positively with several other variables which strengthen an interpretation of U.I. 16 in terms of high self-assertiveness: a person scoring high on U.I. 16 shows high endurance on tiring tasks (M.I. 346), less oscillation of performance (M.I. 13), less attitude shift toward the attitude endorsed by authorities (M.I. 35), is positive and optimistic about his future (M.I. 112: more favorable than unfavorable self-reference in events; M.I. 212: many distant goals considered attainable), and does not change his opinion readily when presented with additional arguments (M.I. 34: less "immaturity of opinion"). "Ego assertiveness" probably also accounts for this person's high level of aspiration (M.I. 101a and M.I. 101b), his carefulness in following instruction (M.I. 50 and M.I. 51) and in obeying rules (M.I. 98a), as well as his tendency to orient his tastes and cultural preference after those endorsed by the upper social classes. This U.I. 16 is correlated with more "high-brow" tastes (M.I. 117), more rejection of questionable books and stories (M.I. 21), and more sense of poetic aptness (M.I. 118)—loadings which all tie in well with questionnaire evidence of significantly higher shrewdness (Factor N+) at the U.I. 16 pole.

3. *Less Impairment of Performance by Frustration*

There are four variables (M.I. 96a, 165, 465, 61) in the pattern of U.I. 16 which consistently indicate less impairment of performance under frustration, disapproval, or distraction conditions. The extreme U.I. 16 person is less sensitive than other persons to such unfavorable conditions—distraction, criticism, and emotional resentments are less likely to result in a decrease of speed or accuracy of performance. Subjects scoring at the extreme positive pole of this factor do not "give in" easily, are more enduring, and try hard to give

a "good performance." In fact, it may be this very characteristic of the assertive individual that explains the slightly better scholastic achievement of the U.I. 16 student to which we referred above. In this group of performances we get evidence of something beyond motivational strength—in a self-assertive sense—as such: namely, some qualities which appear related to the psychoanalytic notion of ego strength. The person is not easily discouraged by failure and controls his impulses well in the interests of eventual success.

4. "Strong" Physique

The assertive psychological properties in U.I. 16 are to some extent "repliated" in the U.I. 16 individual's physique. Already years back, when correlations between body build and factor U.I. 16 were still lacking, we expected a positive relationship between this factor and measures of physical size ("assertive" bodily characteristics). Studies have now verified this hypothesis (44). At its positive pole, the U.I. 16 person is characterized by a generally "big" body, long and thick bones (M.I. 487) and muscles (M.I. 486), and a large amount of fatty tissue (M.I. 485). In addition, results indicate a high excitational level at the U.I. 16+ pole (M.I. 444: high systolic blood pressure; M.I. 78: high involuntary muscle tension in right arm), a kind of enduring physical tenseness.

The negative correlation between U.I. 16 and the endurance time on an exhausting treadmill run (M.I. 492) could be due to a tendency to avoid bodily harm, possibly arising from an overly narcissistic concern about one's health. For what would clinically be called narcissism comes out clearly in a number of contexts. Such an interpretation would also agree with Knapp's (35) finding of a positive correlation between this factor and sick call frequency in a sample of naval helicopter trainees. Both results, however, could also simply point to a poorer physical health at the positive pole of U.I. 16. In Knapp's study direct measures or ratings of physical health were not available; in view of the higher physical strength correlated with U.I. 16, the former interpretation is more consistent with the general pattern of this factor. Indeed, several criteria results below point to the assertiveness of U.I. 16 including a kind of narcissistic overevaluation of the self, a careful regard for one's social and physical well being and, to some degree, a disregard of others. This may not be properly, labelled narcissism or egotism, but it is certainly connected with a wary regard for the security and social and physical well being of the self and a tough determination for self-maintenance.

D. EXPERIMENTAL, QUESTIONNAIRE, HIGHER ORDER, AND CRITERION ASSOCIATIONS

1. *Questionnaire Correlates*

Evidence on questionnaire factor correlates of U.I. 16 is available from five published studies. U.I. 16 correlates consistently with factor I— (Harria: tough, realistic) and, less marked, with factor N+ (Shrewdness: sophisticated, polished). This suggests an interpretation of U.I. 16 in terms of the personality battery: realistic, self-assertive, fact-oriented, tough-minded rather than tender-minded, self-determined, and more sophisticated (or "high-brow") in tastes and values.

The correlations reported by Knapp (33) on the relationship between first-order objective test factors and various questionnaire and inventory scales are in agreement with this general interpretation. On the Guilford-Martin scales, T (Thinking Introversion; $r = +.16$), G (General Activity; $r = +.26$), and A (Ascendence; $r = +.18$) correlated significantly with U.I. 16. On the Guilford-Zimmerman scales, G (General Activity; $r = +.22$), A (Ascendence; $r = +.32$), and S (Sociability) had significant relationships with this factor. With respect to the MMPI scales, Mf (Femininity of Interests; $r = +.32$), Sc (Schizophrenia; $r = +.22$), and L (Lie Scale; $r = -.23$) relate significantly to U.I. 16. The Do (Dominance) scale, derived from the MMPI item book by Gough, McClosky, and Meehl (27), has also been found to correlate positively ($r = +.30$) with U.I. 16. In terms of interests and values, Pawlik (39) uncovered a relationship between Literary Interests on the Kuder and U.I. 16 ($r = +.24$).

At this junction it is necessary to digress briefly for a comparison of the somewhat disjointed alignment between the objective-analytic (O-A) approach to personality based on performance-type instruments and illustrated by the U.I. 16 markers in Table 1, and the questionnaire (Q) approach as exemplified by the 16 Personality Factor Questionnaire. Although the growth of multivariate personality theory has been architectonic, these two separate approaches evolved from different conceptual viewpoints. In his 1957 book, Cattell refers to three strategic approaches to the "personality sphere": namely, the objective-analytic (which yield T data), the self-report or questionnaire (which yields Q data), and the behavior or life rating (which yields L data). Historically, the questionnaire factors emerged from a condensation of the Allport-Odbert (1) list of trait terms in the English language. The 16 PF, after three editions, represents a distilled and rigorous measuring device for handling 16 major

dimensions of semantic self-description at the *phenotypic* level, and eight second-stratum factors at the *genotypic* level (25).

The objective-analytic (O-A) approach stems from a behavior-oriented model that cuts across perceptual, conative, and expressive elements of behavior. Through this approach, Cattell has attempted to describe the personality sphere by sampling "all points of the compass," rather than by relying solely on self-report devices.

A recent and stimulating development at the Laboratory of Personality and Group Analysis is an "ecumenical" attempt to bring these two streams of personality measurement together. A research project is currently attempting to bridge the gap by constructing a series of devices that "tap" the objective-analytic factors through the questionnaire type of item. To accomplish this, a special *O-A Youth Inventory* (Forms A and B) was constructed with items hypothesized to "load" a specific O-A factor, such as U.I. 16. After the traditional factor analysis and rotation procedure with the T data obtained from 12 year olds, the battery of experimental items will be "projected" on the final structure through the Dwyer Extension Analysis procedure (24). Questionnaire scales will be constructed along the lines dictated by those items that have the highest saturations on each of the objective personality factors. The scales that emerge will represent nodes around which additional items will be constructed to conform to our current understanding of the psychological nature of the objective factor.

2. State Factor Matches

A recent development in multivariate personality theory is a concern for process and modification over time (8). Traditionally, the distinction has been made between *traits* of personality and *states* of personality (12). A *trait* is a structural element and is thought to have contemporary relevance for personality description. A *state*, on the other hand, refers to an ongoing event that may have permanence over time and may manifest cyclic activity (such as elation *vs.* depression). Operationally, state factors have been evoked to account for observed differences in trait performance from one occasion to another. None of the 12 state factors so far identified in the objective personality test realm resembles the psychometric pattern of U.I. 16 closely enough to justify a match (32), nor was U.I. 16 found in the incremental R-technique study reported by Cattell and Scheier (17). The recent work of Nesselrode (38) does not add to our knowledge of U.I. 16, but does contribute to our understanding of traits and states. Since we are concerned with personality structures that function *over* time (diachronic processes), not just those that exist *in*

time (synchronic processes), Nesselroade argues that state factors be given prominence in theory building and trait factors regarded solely as a "limiting condition" of the more generic state processes.

3. *Loadings on Second-Order Objective Test Factors*

In a recent study, Gorsuch and Cattell (26) attempted an experimental clarification of super ego structure. Their factor analytic investigation included eight objective test factors (Ego Assertiveness, U.I. 16; Comention, U.I. 20; Anxiety, U.I. 24; Narcistic Self Sentiment, U.I. 26; Rigid Super Ego, U.I. 28; Willed Responsiveness, U.I. 29; Introversion-Extraversion, U.I. 32; and Autism, U.I. 34), two factors in the questionnaire domain (Super Ego Factor, G; and Self Sentiment Factor, Q₃), and two components in the dynamic motivational region (Super Ego Sentiment and Self Sentiment found in the Motivation Analysis Test, MAT). At the first-order level of analysis, U.I. 16 emerged from the factoring and was characterized by *fast natural tempo* (M.I. 287 and M.I. 9) and *self confidence* (M.I. 125). The factors at the first order were intercorrelated and a second-order factoring was applied to the correlation matrix. The results at the higher-order level of analysis suggested that Ego Assertiveness (U.I. 16) is part of a dynamic self-sentiment factor distinct from the dynamic super ego sentiment factor.

In another study directed toward the structure of the self, Cattell and Horn (15) found that, at the second-order level of analysis, U.I. 16 had its major "loading" on a factor clearly identified as Expansive Ego (T.III), and a slight projection on a factor labeled Self Sentiment Control (T.V.). This study was provocative in that Cattell and Horn carried their analysis to the third stratum. At the third and final level of analysis, the Expansive Ego factor (T.III) projects uniquely onto a dynamic factor designated TC, and tentatively labeled Expansive Ego *vs.* Low Ego Strength. Pawlik and Cattell (40) have interpreted the Ego Assertive personality factor at the second- and third-order as congruent with the psychoanalytic concept of "ego strength."

4. *Criterion Correlations*

In this section we will survey some of the "real life" correlates of U.I. 16, notably in the clinical, academic, and personnel selection fields.

a. *Clinical criteria.* In studies reported by Cattell and Scheier (18) and Cattell (7), neurotics scored significantly lower than normals on U.I. 16. Besides the personality factor U.I. 25 (Less Imaginative, Task-Oriented Realism *vs.* Tense Inflexidia), U.I. 16 is an important factor in distinguishing between neurotics and criminals. In an extensive project at Alton State Hospital (Alton, Illinois) concerned with the diagnostic value of the O-A

Test Battery, U.I. 16 is a salient factor in distinguishing a Hospitalized Patient Group from Nonhospitalized "controls." Both paranoid and non-paranoid schizophrenics differ significantly ($p < .001$) from a Control Group and are characterized by "unassertiveness"—U.I. 16(—). Within the Schizophrenic group itself, Paranoid Schizophrenics did not differ from Nonparanoid Schizophrenics with respect to Ego Assertiveness. An important study is being conducted by Dr. George Pierson on the role of U.I. 16 in the formation of delinquency patterns in adolescent boys.

b. School and academic achievement. No completely significant relationship has been found between U.I. 16 and college achievement (39), although high achievers tend to score higher on ego assertiveness than do low achievers. The Laboratory of Personality and Group Analysis is currently analyzing data that will yield important information concerning performance on the objective personality test battery and school achievement.

c. Military criteria. In an Air Force study, Cattell, Schiff, *et al.* (22) found a correlation of $+0.16$ between U.I. 16 and "actuarial adjustment rating," based on the ratings of two clinical psychologists on a 24-item evaluation scheme. Knapp and Most (36) found the factor correlated $+0.37$ with the total score on the AQT (Aviation Qualification Test), but negatively (-0.39) with peer ratings of pilot proficiency; also a moderately high relationship ($r = +0.52$) has been discovered with sick call frequency (34). It would be most valuable to replicate this latter finding on absenteeism rate in an industrial setting. In an additional study by Knapp (35), factor U.I. 16 correlated significantly with both the Pass-Fail criterion ($r = +0.23$) and the Class Standing criterion ($r = +0.22$) in naval submarine training.

These results indicate a general competence, efficiency, and determinedness as characteristic of the positive factor pole. There is, however, no evidence at this time that the high U.I. 16 person would also show a better actual on-the-job performance in the military (or industrial) setting. In fact, the correlations between U.I. 16 and objective flight performance measures are insignificant in two studies cited above (22, 36). The significant negative correlation with peer ratings of pilot proficiency probably indicates low overall sociometric status of the U.I. 16(+) person, rather than actual poor performance as a pilot. This interpretation of "negative social desirability" seems plausible in light of the assertiveness, dominance, and narcissistic and determined individualism associated with U.I. 16(+).

5. Nature-Nurture and Age Trend Results

Among the 10 personality factors (U.I. 16, 17, 19, 20, 21, 22, 23, 26, 28, and 29) for which nature-nurture results are available, U.I. 16 is the factor

most strongly determined by environmental influences (21). Since these data were obtained with children of an average age of 12 years, Cattell has hypothesized that this very marked environmental determination of U.I. 16 must date from the early and middle childhood period, in which case the psychological influences originating in the home environment (parents, sibs) and in social interaction with playmates will probably account for the main part of the nurture variance in this factor. The development of the Multiple Abstract Variance Method, termed MAVA (10), has set the stage for rigorous experimentation to ferret out the contribution of genetic situational determiners on continuous personality factor scores.

At present, there is only a modicum of evidence concerning age trend in mean U.I. 16 scores. Cattell (6) presented some evidence to indicate that U.I. 16 shows the least change in mean level over the age range from 9 to 15 years.

E. DISCUSSION HYPOTHESES CONCERNING U.I. 16

At this juncture, a succinct account may be presented for the status of the ego assertive personality factor: U.I. 16 is a trait rather than a state pattern, it is highly molded by environmental forces, it emerges early and increases steadily with age (but levels off after 10 years of age). It contributes to success in most fields in which it has been examined, but not necessarily to peer group popularity. Neurotics and psychotics are subnormal on U.I. 16 and delinquents and criminals are above normal. Its general character is briefly one of competitive and, possibly, egotistical self-assertion. In second and third order factor structure it forms the core of factors that have been identified with the psychoanalytic concept of ego strength (16).

The first theory of Cattell (personal communication) about this factor is expressed in its title "ego assertiveness," which conveys both the idea of the competitive, assertive motivation and that of a structural connection with the ego concept found in psychoanalytic parlance. Cattell has called attention to the recent evidence on activation (E.E.G.) associations and the higher order association in factor analytic investigations as important clues in understanding the nature of U.I. 16. The E.E.G. evidence is particularly interesting, since it indicates that high U.I. 16 behavior is connected with alpha wave interruption in the *frontal* lobes (41), as distinct from the general and occipital interruption associated with activation level, U.I. 22 (20).

Factor analytic evidence indicates that U.I. 16 is consistently the most highly loaded primary on the second order "Ego Expansiveness *vs.* History of Difficulty in Coping with the Environment" factor, and that the latter, in turn, is a contributor to the third order factor called "High Assertiveness."

The experimental issue here is whether, with improved measurement and sampling techniques, U.I. 16 would turn out to be *largely* this third order factor (linked to the psychoanalytic ego concept), or whether it is a relatively specialized, but important, manifestation of the ego determined by some local (e.g., family milieu) expression. Only very careful statistical work with O-A battery measures of the highest validity for U.I. 16 can finally answer this.

Pending this and other experimental checks, Cattell's final thinking is that U.I. 16 is an aspect of ego strength concerned particularly with confident and skillful responses in the area of competitive self-assertion. He has hypothesized that either U.I. 16 or the total cortical high activation pattern connected with U.I. 16 and U.I. 22 (Cortertia) together will align with the second-order questionnaire personality factor QIII, which is defined by the pattern A— (Sizothymia), C+ (High Ego Strength), I— (Harria), M— (Praxernia), N+ (Shrewdness), and Q₂— (Group Adherence).

To the clinical theorist, the network of complex facts—quantitative and intractable—with which we here have to deal, demands theoretical constructs of a not too simple nature. Principally, it demands the qualifying notion of "part functions" corresponding to factors operating at different orders. But the implication here that ego strength, though a unitary factor, has "parts" should not surprise the clinician any more than the discovery that the anxiety factor, U.I. 24, appears also as a set of influences on or from primary factors in the questionnaire domain (18). There are now at least three well-supported instances of some major personality traits (e.g., ego assertiveness, exvia-invia, and anxiety) having recognizable specialized modes of expression at a distinctly lower order, apart from the more pervasive expressions. No attempt is being made here to claim that the "ego" is *nothing but* U.I. 16, for within multivariate personality theory three other well-known empirical patterns may claim the "ego strength" identification—namely, Factor C in the 16 P.F. Questionnaire, Factor T II among the second-order O-A factors, and Factor TC at the third-order O-A level.

One difficulty in Cattell's hypothesis concerning U.I. 16 as a pattern of Ego Assertiveness *vs.* Restricted Ego, specifically linked to a particular dimension of family atmosphere operating in early childhood, is that the family pattern itself has not been defined nearly as well as has U.I. 16 itself. Cattell's (5) discussion of the family dimension problem admits that no thorough factoring of the behavior of such groups has been definitive, and therefore, he has tentatively accepted the Baldwin, Kalhorn, and Breese (2) correlation *cluster* (surface trait) as most nearly defining an Overprotective Restrictive *vs.* Nonchalant Realistic dimension. The addition of a slightly different slant to the Baldwin Overprotective-Nonchalant cluster, as indicated by the ap-

pended terms, connotes at the nonchalant-realistic pole only a tendency to leave the child free to make his own decisions and solve his own problems, but also the provision of facilities to do so (such as would occur more with an only child, knowing only the standards of adults).

At the opposite overprotective-restrictive pole we have, along with the provision of a secure and sympathetic environment, a certain smothering by authority, and a definite curtailment of the right of the child to develop his own ego and accept the consequences of his own mistakes. The positive U.I. 16 pattern thus comes to express competitiveness, confidence in decision, some insecurity shown in the high striving and speed, an unrestricted exploratory attitude toward the environment, and a certain scepticism and realism about the world. It will be noted that this generalization on "degree of liberal permissiveness" within the family fits the older, but still firm, results of Symonds (43) on indulgence *vs.* rejection and personality formation. The recent survey of consequences of parental discipline by Becker (4) supports the Cattell environmental hypothesis, but obscures the picture by adding a Warmth *vs.* Hostility dimension to the Restrictiveness *vs.* Permissiveness classification.

The present writer would like to conclude by sketching some research directions posed by the Cattell hypothesis connecting a personality dimension with a family upbringing dimension. At the Laboratory of Personality and Group Analysis (University of Illinois), the writer is presently analyzing data obtained from an extensive investigation of preschool children between the ages of 4 and 5 years. One purpose of this study was to evolve a stable and highly reliable objective-analytic test battery of U.I. 16 and to validate this dimension (along with several other factors) against Digman's (23) multiple-factor model of child personality based on nursery school teacher-ratings. A forthcoming facet of the ongoing project will be to evolve an adequate multivariate measure of Cattell's home atmosphere dimension (Overprotective Restrictive *vs.* Nonchalant Realistic), discussed quite thoroughly by Becker (4), and to test the hypothesis stated earlier. Parenthetically, we are extremely interested in ferreting out those familial influences that differentially contribute to ego formation, apart from superego (U.I. 28) development (9). Only through the integration of *correlational* and *experimental* methodologies (the "disciplines of scientific psychology") will multivariate theory evolve an adequate system to understand the ontogenesis of the ego assertive factor, U.I. 16.

F. SUMMARY

A social observer (42) recently noted that Non-Westerners fail to understand that the West's envied economic progress is not a matter of technological

advancement alone. It rests on a constellation of character traits developed over centuries of Western history: an assertive individualism; a secure, well-defined ego; a Faustian drive to learn and master. The present writer proposes the hypothesis that the ego-assertive factor, U.I. 16, is the core of this particular orientation toward the world. The cross-cultural implications of this hypothesis have not escaped research psychologists. In collaboration with the Laboratory of Personality and Group Analysis, a comparative study of three cultural settings (directed by Pawlik in Austria, Tsujioka in Japan, and Cattell in America) is currently in progress. Direct comparisons will be made on the ego-assertive dimension (along with other "personality sphere" factors) and the differences linked to variables operative both *between* and *within* each milieu. Although our knowledge of ego assertion is incomplete at the present time, recent advances auger well for the future of multivariate personality theory.

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INCUBATOR ISOLATION AS A POSSIBLE CONTRIBUTING
FACTOR TO THE HIGH INCIDENCE OF EMOTIONAL
DISTURBANCE AMONG PREMATURELY
BORN PERSONS*

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A. INTRODUCTION

Recently in the United States there has been a growing interest in the premature child. Increasing expenditures of money and of time and energy by professional people are being utilized to improve the care of the premature infant. Along with the hope that these efforts will reduce the mortality rate, particularly among low weight preemies, is the growing awareness of the need to help these youngsters develop into healthy, well-adjusted individuals (3), for several studies have pointed to the higher incidence of emotional disturbance among individuals born prematurely as compared with full term babies.

These investigations have mentioned several possible factors contributing to the prevalence of emotional disorders in these prematurely born people, but they have never considered the possibility that incubator isolation might be one of the causative agents. It is therefore the purpose of this paper to present data which will substantiate this hypothesis and lead to further studies on the effects of incubator isolation on the child's early development.

It was a quarter of a century ago in 1939 when Dr. Mary Shirley first referred to the prematurity syndrome when she said that, "The possibility that the premature ejection of an individual into a world he has not grown up to fit may have lasting social and emotional consequences" (16, p. 115).

Before we take a further look at this prematurity syndrome, however, we need to define the term, "premature," as it refers to the newborn infant. According to the definition adopted by the World Health Assembly in 1948, a premature baby is a live-born infant weighing less than five pounds, eight ounces or 2500 grams at birth, or a live-born infant with a gestation period of less than 37 weeks. In 1956, 7.6 per cent of 4,163,090 live-born infants in the United States, according to this definition, could be classified as premature (5).

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B. THE PREMATUREITY SYNDROME

In 1939 Shirley noted that several characteristics occurred with considerable frequency in the premature child's development. She found them to be more irritable, more shy, and more negativistic than the full term baby. At the same time she observed that they were very much attached to their mothers and very likely to seek help from them or from any friendly adults upon encountering the slightest difficulties. She also noted that these youngsters possessed very short attention spans.

Shirley observed that in auditory sensitivity the premature child is either more keenly aware of sounds or more interested in their meaning than is the full term child. The premature child appears to be highly distracted by foot-falls or voices, traffic noises, and by the sound of other babies crying. Aesthetically he has a greater appreciation of beauty and a stronger artistic desire to create than the full term baby, but at the same time he has poor motor coordination to follow through his keen sensitivity awareness. These observations were quite well substantiated in a longitudinal study at the Center for Child Health and Development, Harvard School of Public Health, cited by Shirley in 1939. The subjects were 44 children, 22 premature and 22 full term controls of ages $2\frac{1}{2}$ to 5 years. In Tables 1 and 2 each premature child was matched with a full term child of the same age, sex, and ordinal position in the family. None of these traits was consistently sought in either group. Just chance observations and incidental notes were recorded at the mental examination. This prematurity syndrome was also observed in a study of 60 children, 30 premature and 30 full term.

It may be noted that the crying in the playroom represented a greater degree of insecurity than crying during the examination period. The crying in the playroom appears to result from loneliness and a desire by the child for his mother, while the crying during the examination usually results from the child's distaste for the procedures involved.

Shirley, in her interpretation of the causal factors underlying the prematurity syndrome, discussed several possibilities. Among these she mentioned that toxemia and multiple pregnancies, which are common causes of premature births, both provide less than favorable prenatal environments. She also noted the fact that premature births are often traumatic. "At birth the premature suffers a more prolonged weight loss and an arrest in development that writes its permanent record in the growth of the bones; may it also not write a permanent record in that much more plastic tissue, the nervous system?" (16, p. 125).

She goes on to say that the premature is more capable of experiencing sensory

stimuli than he is of performing motor functions. He is therefore a person whose "reach exceeds his grasp." He is highly receptive to stimulation but less able to make an adequate motor adjustment to the stimulus. The frustration ensuing from this inability to manipulate materials may be an underlying factor in his high degree of irascibility, which he expresses in petulancy and

TABLE 1
PREMATURITY SYNDROME AS OBSERVED AT MENTAL EXAM

Trait	Premature ($N = 22$) Frequency per cent	Controls ($N = 22$) Frequency per cent
Shy	50	37
Very distractible	45	13
Distracted by sounds	18	4
Short attention span	13	9
Cried-impossible to test	32	23
Throwing toys to floor	13	9
Tremble	9	4
Give up, easily discouraged	18	0

Note: This table, as taken from "A behavior syndrome characterizing prematurely born children," by Mary Shirley (16, p. 120), is reprinted by permission of the Society for Research in Child Development.

TABLE 2
PREMATURITY SYNDROME MANIFESTED DURING PLAY PERIOD

Trait	Premature ($N = 30$) Frequency per cent	Controls ($N = 30$) Frequency per cent
Remarks about unusual sounds	67	37
Speech difficulties	60	23
Cry in playroom	80	57
Cry at exam	60	77
Attention to crying of other children	37	20
Rapid change from toy to toy	43	23
Scattering toys	23	17
Seeking help	43	17
Giving up discouraged	27	10
Jittery, nervous	83	27
Defecation at center	40	30
Five or more urinations	27	12

Note: This table, as taken from "A behavior syndrome characterizing prematurely born children," by Mary Shirley (16, p. 120), is reprinted by permission of the Society for Research in Child Development.

in his tendency to throw or scatter toys. This lag between stimulation sensitivity and motor performance could in turn lead to his short attention span and to a subsequent versatility of interests and the development of many hobbies, a trait which appears to be characteristic of adult prematures. Actually it is even conceivable that the premature's stubbornness and this tendency to give

up a task before completing it may well be a means of reducing the amount of stimulation he receives.

Shirley points out that premature babies also differ markedly in their post-natal development, as contrasted with full term babies. They are more deprived and at the same time they are more isolated than full term babies. During their early weeks of life they are more isolated from human contact, and for months they are watched over with more solicitude. Their mothers first tend to underestimate and then later overstimulate them, hoping that their premature offspring will catch up with the norms for average full term children. This oversolicitation on the mother's part frequently results in increased dependence of the child on the mother and shyness and withdrawal from other adults. At the same time one should note that the high degree of maternal solicitude combined with the poor motor functioning may offer a possible explanation of the premature's greater dependency upon others, even in cases of minor difficulties, and his readiness to give up quickly in the face of the slightest adversity.

Prematures, because of their early isolation in incubators, are likely to be deprived of breast-feeding. Shirley notes that as a consequence they are more likely to be thumb suckers. She also mentions the fact that premature babies have more difficulty in achieving sphincteral control. According to psycho-analytic theory, this could lead to emotional complications in regard to excretory functions and perhaps to an arrest at the anal stage of development.

In summarizing Shirley's findings, it is apparent that she has attributed the higher rate of emotional disturbance among premature babies mainly to some five or six factors: unfavorable prenatal environment, traumatic birth, over-protection and then overstimulation by the mother, the lag in motor development as compared with sensory development, and the deprivation of any opportunity for breast feeding. Nowhere does she discuss the possibility of the early weeks of isolation for the prematurely born child in an incubator being a contributing factor to the later high incidence of emotional disturbance. Is it not possible that the lack of early visual cues, which are not provided by incubator living and which the full term child usually receives almost from birth, might contribute to the subsequently slow motor development in the preemie and thereby to his low frustration tolerance, his unusually high dependency on others, and his low degree of perseverance?

C. RECENT STUDIES ON SENSORY AND EMOTIONAL DEPRIVATION IN ANIMAL INFANCY

In order to assess the impact of incubator isolation on the premature infant's development, one must first take a look at the research which has been done

in the area of sensory and emotional deprivation among infants of the lower animal species.

In 1954 Beach and Jaynes reported that "Most primates depend heavily upon visual cues, and it is not surprising that a lack of visual stimulation in early life has pronounced effects upon subsequent behavior. It may result in inability to respond adaptively to visual cues when such cues first become available" (1, p. 242). They went on to say that there is reason to believe that other types of sensory deprivation in infancy may also affect subsequent behavior. For example, a young chimp with badly injured paws in infancy never had the opportunity to climb extensively as a baby. Consequently, even after the paws had healed, the chimp rarely climbed and tended to show dizziness whenever he was more than a few feet off the ground.

Beach and Jaynes made a study of emotionality in dogs. They contrasted three dogs raised as pets with human handling with three dogs raised in restricted laboratory cages with a minimum of human contact. When these six canines became adults, the three animals raised in a restricted environment differed from the dogs raised as pets in their displaying of a "freezing" type of behavior whenever they found themselves in an unfamiliar setting. These same investigators also noted similar behavior of birds reared in isolation, in that they tended to show fearfulness when they were placed with the flock and also resorted to pecking other birds.

In another study of dogs, Thompson and Melzack (18) studied Scottish Terriers to learn if early deprivation would have a permanent effect upon the dogs' intellectual functioning, their activity, their emotional reactions, and their social behavior. At weaning, four weeks of age, the litter was divided into two groups with one group raised normally as controls. The experimental group was confined, one dog to a cage with opaque sides and top so that the animal could not see outside. The dogs were fed with food in a small adjoining box, each with a sliding door, which was opened from the outside to let the dog into its "dining room." Then the doors were closed and the cages were cleaned while the dogs were eating, so that they never saw their keepers. They were kept in this environment for seven to 10 months, at which time they were released and given the same handling and daily exercise as the controls, which had been brought back from their homes to the lab. After their release the experimental dogs were surprisingly active and playful. In tests measuring their activity level for 30 minutes, the control group soon became bored while exploring a small room and quietly relaxed, but the experimental group went on exploring for a considerably longer period of time. The amount of activity was noted to vary inversely with age; the older dogs became bored more readily than the younger ones, thereby supporting the idea that the active

behavior of the experimental dogs was evidence of immaturity. Even several years after their cage experiences, the experimental Scotties showed more activity than did the controls, indicating that the effects of their early experiences were long lasting. Actually the control dogs showed more intelligence than did the experimental dogs, for they were curious about any new situation but demonstrated an ability to satisfy their curiosity more quickly.

Hypothesizing that the experimental dogs would react differently to fear from the control group and that some fears cannot be explained by conditioning, Thompson and Melzack exposed the experimental group to various strange stimuli, such as a human skull, three weeks after their release from their cages. Normally reared young Scotties usually run away from such objects, showing little excitement. The previously restricted Scotties, on the other hand, reacted very differently, becoming highly agitated and displaying much excitement but little purposeful activity. Their behavior was "diffuse" or "undifferentiated." They did not seem to know what to do about the strange object. A year later the same test was repeated. This time the normally raised dogs now added a new response to their earlier avoidance: they attacked the object in a playfully aggressive manner, growling, barking, etc., while the restricted dogs now showed considerable diffuse excitement and for the first time also demonstrated purposeful avoidance. In other words they had now reached the stage of response which the normal dogs had achieved one year earlier. This experiment tends to indicate that hereditary patterns of adaptive behavior like avoidance and aggression emerge only after an animal has had sufficient experience in a stimulating environment over a long period of time. Without this experience, the animal appears to use much diffuse energy.

Another question posed by these studies of Thompson and Melzack was how an animal deprived of early stimulation will respond to a painful stimulus. In an experiment the dogs were pursued by a toy car, which gave off an electric shock when it hit them. The normal dogs quickly learned to avoid being hit (their mean average was six shocks); they reacted calmly and deliberately. The restricted dogs, however, behaved in a wild manner. Even after receiving shock (their mean average was 25 shocks) they behaved in an excited manner whenever they saw the car. To this and to other painful stimuli they behaved as if they were unaware of the source of their pain. The normal Scotties would dash away from the pain-causing stimulus, while the restricted dogs continued to spend more time around these pain-causing objects, after they had been hurt by them, even toying with them and walking into them. Apparently if an animal does not learn an appropriate response to pain in infancy, he is not likely to achieve the calm, mature response of an adult.

In 1958 Levine (10) proposed that the manipulation of rats during infancy prior to weaning had a much more profound effect on their subsequent behavior than does handling in later life. To demonstrate the soundness of this hypothesis, he established three groups. The first group ($N = 16$) were handled two minutes daily from birth until the twentieth day of life. The second group ($N = 13$) were handled from the fiftieth to the seventieth day of life, being picked up and held but not fondled, as was the first group. The third group ($N = 19$) received no handling until the day of adult testing. All three groups of subjects were tested at 71 days of age in a conditioned avoidance learning situation. A shock was delivered at one-second intervals with each shock lasting .1 seconds in duration. The conditioning stimulus was a low 60-cycle hum. Two days were devoted to acquainting the rats with the experimental box followed by conditioning avoidance training. The first day the rats were placed in the box for three minutes, an experience which served as a modified open-field test to measure their degree of emotionality. On the second day two-inch hurdles were placed in the box, and the subjects were given another three-minute trial, this time with the conditioning stimulus (the 60-cycle hum) turned on. The number of instances of defecations and the number of hurdle crossings were recorded, but no shock was administered. The third day avoidance training was begun. First the conditioning stimulus was introduced, then the shock followed, and the subjects had to try to escape the latter by running back through the door to the starting box. In determining the results of the rats' behavior in regard to emotionality, defecation was used as a possible indicator of emotionality, as was "freezing," which was defined as complete immobility prior to the onset of the conditioning stimulus. Another criterion of emotionality was the activity level of the rats (the number of hurdle crossings during the second encounter with the experimental box). Table 3 shows the degree of emotionality in the three groups of rats.

The results of this study appear to indicate that there are several effects realized from early handling of rats. First of all early handling apparently increased the rats' perceptual experience. Secondly, it provided relationship reinforcement. Lastly, it affected the rats' handling of stress, which was perhaps the most critical effect of the handling, in that such stimulation is at first fear-producing and also a noxious stimulus; but, if it is experienced in early life, it may conceivably help the animal to adapt to later noxious stimulation. Evidentially the process of adaptation is inversely related to the age at which the experience with the noxious stimulation occurs.

To substantiate the results of this study further, two years later in 1960 Levine reported in another study (11) that it is those animals that serve as

nonmanipulated controls that exhibit the greatest deviations in behavior and physiology when first subjected to stress as adults. He noted that nonmanipulated animals, when placed in the unfamiliar environment of a neutral transparent box, would crouch in the corner of the box, while animals subjected to stress in early infancy freely explored their unfamiliar surroundings.

Levine also observed that the patterns of the stress response in the two groups of animals were quite different. He stated that the steroid output appears to be influenced by stress. Though both the experimental and the control groups showed the same steroid volume in their circulation prior to the

TABLE 3
SUMMARY OF EMOTIONALITY MEASURES IN RATS

Group	Mean frequency of hurdle crossings	% defecation	% freezing	Mean number of freezing trials
Early handled rats ($N = 16$)	7.25	0	18	.44
Late handled rats ($N = 13$)	6.92	38	93	1.69
Nonhandled rats ($N = 19$)	4.95	58	65	2.37

Note: This table, as taken from "A further study of infantile handling and adult avoidance learning," by Seymour Levine, (10, p. 76), is reprinted by permission of the Duke University Press.

administration of electric shock, the animals exposed to stress in infancy were noted to have a much higher initial output of steroids during the first 15 minutes following shock, while the nonstimulated animals achieved the same steroid content, but it occurred more slowly and the output continued at a high level for a longer period of time. The swift, short duration of the steroid response in the previously stimulated rat apparently served the function of rapidly mobilizing his resources to cope with the stress situation, while the delay in the steroid response of the nonmanipulated rat was indicative of maladaptive physical arousal. In addition, it is quite likely that the prolongation of the stress response, observed in the control group which had had no previous stimulation, could result in damaging physiological consequences: for example, stomach ulcers.

In line with this evidence has been the interesting discovery that stimulation by handling and stress actually hastens stress response maturation in the infant rat by some four days, which would be equivalent to several months of development in the human infant. Apparently early stimulation accelerates the maturation

tion of the rat's central nervous system, evidence of which has been substantiated by analysis of the brain tissue of the subjects of Levine's stress studies. Actually stimulated infant rats exhibit a more rapid rate of growth in several areas. For example, they open their eyes sooner and develop motor coordination earlier than rats which have not been handled. Such precociousness appears to be related to a greater output of the somatotropic or growth hormone from the pituitary gland.

Among the questions which need to be answered is that regarding the critical infantile period or periods during which stimulation may be most effective. Thus far, evidence appears to point to the period following birth as being most crucial in the stimulation of rats. A study by Levine in 1960 of animals in three separate groups, which were handled four days each, was undertaken. The first group was handled from the second through the fifth day. The second group was handled from the sixth through the ninth day, while the third group was handled from the tenth through the thirteenth day. Upon testing for the stress response on the fourteenth day, the first group was the only one showing evidence that they were capable of an endocrine response. At the same time, however, it should be noted that this does not mean that stimulation has no effect after the critical period or that one given critical period determines all responses.

It cannot be said that this phenomenon of infant stimulation affecting the behavior and physiology of the rat is limited to the rodent species. The effects of early experiences have been noted to be significant in the studies of many mammals, such as the cat, the dog, and the monkey.

Turning to related studies of stimulation in the infant monkey, perhaps some of the most significant findings have been those of Harlow (8), who maintains as a result of his research that love in the young rhesus monkey derives mainly from close bodily contact. Using cloth and wire mother surrogates during the infants' first 14 days of life, Harlow noted that the infants spent most of their time clinging to the soft cloth "mother," even when their bottles were attached to the wire mother. Contradicting the theory that affection is a learned response or one derived in association with hunger or thirst reduction, he observed the vital role played by bodily contact and the comfort it supplies in the infant's forming an attachment to its mother.

In the next phases of this study, the question of the relationship of emotional attachment in moments of emotional stress was investigated. Apparently close intimate contact with the mother would alleviate fears arising from the exposure of the monkey infants to strange stimuli, such as a mechanical bear, which would move forward while beating a drum. In the absence of the cloth mother the infants when confronted with stressful situations would show their distress

by crying, crouching, rocking, and thumb and toe sucking. Harlow goes on to say that though bodily contact surely plays a major role in the development of infantile affection, there are probably other types of stimulation which add to the baby's experience. For example, the motion stimulation provided by a live monkey mother could perhaps be considered equivalent to the human mother's rocking or walking her baby, or equivalent to the movement provided in some of our more primitive cultures by mothers who bind their babies to them and then go about their daily chores. Even the act of clinging appears to have importance in promoting infant psychological and physiological development. In an open field test infant monkeys raised in a crib without a mother did derive some emotional support from the crib's presence, but those raised with both mother and crib showed a definite preference for the mother, to which they could cling, and they also showed evidence of receiving superior emotional support from her.

In addition, the factor of visual stimulation becomes apparent at three months, when the monkeys begin to observe and manipulate the head, face, and eyes of their mother substitutes. It appears that such stimuli may have profound effect on the phenomenon of imprinting.

To test further his hypothesis on the desirability of early stimulation, Harlow used four infant monkeys as a control group, denying them any physical contact with either a surrogate mother or with other monkeys. After eight months of isolation, they were placed in cages with access to both cloth and wire mothers. Although demonstrating fear of both of these objects at first, they began to respond within a few days, especially to the cloth mother surrogate, in a way similar to that of the other infants. However, it was noted that these isolated monkeys spent less time and gained far less reassurance from the cloth monkeys than had the experimental group. It was quite evident that the deprivation of physical contact during their first eight months of life had affected their ability to develop the full, normal pattern of affection. In later separation of both groups from the mother surrogate, the experimental infants, who had been raised with the substitute mother, when separated from this object of affection at $5\frac{1}{2}$ months, revealed little or no loss of responsiveness even after a year and a half of separation. The control group, which had had contact with a mother surrogate only after the age of eight months, quickly lost whatever responsiveness they had acquired.

At this point the question may well be raised that the absence of stimulation and its ill effects in animal infants would not necessarily apply to human infants. Before coming to any hasty conclusions on this matter, however, it will be necessary to take a look at the topic of sensory and emotional depriva-

tion in human infants, a subject which has become more and more widely investigated during the past two decades.

D. THE PHENOMENON OF HUMAN INFANT ISOLATION AND PSYCHOLOGICAL DEPRIVATION

As early as the 13th century, King Fredrick the Second referred to the effects of maternal deprivation when he told about experimental conditions creating such extreme environmental deprivation that all of the subjects died. "For they could not live without the petting and joyful faces and loving words of their foster mothers" (20, p. 93). It was not until the beginning of the 20th century, however, that the first direct observations of such effects were reported by pediatricians. In 1909 a report was made of the physical and psychological deterioration occurring in hospitalized infants. Actually it has been only in the past 20 years that a concerted effort has been made to study the various factors involved in the deprivation of maternal care.

It was in 1944 that Margaret Ribble (15) reported on a study of 600 infants observed over a long period of time in three different maternity hospitals, which varied their infant care methods, plus home deliveries. She hypothesized that the evidence of security and insecurity in the infant was manifested by physiological factors, such as respiratory changes, changes in the tautness of the skin, and general tension. She investigated the factor of pleasure-getting and the manner in which the tactile and kinesthetic senses influenced the child's primary orientation and contributed to his sense of reality, and she concluded that these factors were related to the child's innate need for contact with the mother. She noted the presence of exaggerated tension states in 30 per cent of the 600 infants and said this tension disappeared when the child was placed in close contact with his mother's body, or was stroked about the head or face, or was rocked. She pointed out that infants who did not receive this sort of mothering "stimulation" showed growing, persistent muscular tension, which was accompanied by inadequate breathing. She referred to this phenomenon as "the tendency toward functional disorganization" (15, p. 629) and said that it was characteristic of the first three months of human life.

Even though Orlansky (12) in 1949 and Pinneau (13) in 1950 both stated that there was little evidence to substantiate Ribble's theories of functional disorganization, they did not overrule her hypothesis that human contact and affection was necessary for healthy development of the child. Certainly one should take note of Ribble's comments on the kinesthetic satisfaction that infants receive from being held, moved about, and fondled by their mothers and of the observation that the sound of the human voice, which at first elicits

a startle reaction, after the first week of life exerts a soothing influence on the child. She concludes that infants who do not receive adequate mothering tend to react in one of two ways: (a) they demonstrate negativism, such as a refusal to suck with a loss of appetite and hypertension or rigidity of body muscles; or (b) they show regressive quiescence, a form of depression with oral lethargy, stuporous-like sleep, and a loss of muscle tone.

At approximately the same time that Ribble was presenting her findings, R. A. Spitz (17) was reporting on the development of psychogenic disorders in infants separated from their mothers for periods of six weeks or more. He referred to this disorder as "hospitalism" and said that it was characterized by severe developmental retardation. He took two groups of babies, one group with a foundling home background in which all mothering was absent from the third month onward, and the other group with a nursery environment where mothering or substitute mothering was a daily part of the program. Using the Hetzer-Wolf baby tests, Spitz reported that the youngsters from the foundling home showed extreme retardation in their developmental quotient as compared with the nursery group, which showed normal development. He went on to report that the foundling home children also showed extreme susceptibility to infection and illness of any kind. Of 91 children up to the age of $2\frac{1}{2}$ years, 34 died in this group. Of 122 infants in the nursery group, where constant mothering had occurred, not a single child died.

Even though Pinneau (14) is critical of the Spitz studies as being unreliable, it is evident that Spitz introduced the concept of maternal deprivation, which has been the subject of much investigation during the past 20 years.

In 1945 Goldfarb (7) also noted that as early as the sixth month of life, or possibly sooner, one can observe an attachment of infants to particular persons. Where the child is deprived of this type of experience through institutionalization, he later tends to develop an isolation type of personality, characterized by unsocial behavior and hostile aggression. As a consequence, he fails to acquire a pattern for giving and receiving affection or an ability to understand and accept limitations placed upon him so that he develops considerable feelings of insecurity in adapting to his environment. Goldfarb goes on to point out that the institutionalized child is more retarded mentally, more immature in his perceptual reactions, and more immature in his level of conceptual performance. He mentions that such children also show more occurrences of restlessness, hyperactivity, inability to concentrate, a lack of popularity with their peers, poor school achievement, fearfulness, and an excessive desire for affection. It is of interest to note that most of these traits are also characteristic of Shirley's prematurity syndrome.

Goldfarb reported on studies of 15 children reared in institutions until the age of three *versus* 15 children reared in foster homes. He disclosed a difference of 28.28 *IQ* points between the two groups when they were tested at 34 months of age. The first group mean *IQ* was 68.10 points, while the foster home group *IQ* average was 96.38. When a retest was carried out seven months later, after foster home placement of the institutionalized children, the mean *IQ* which had risen to 75.84 was still 25.68 points different from the original foster home group whose *IQ* had now risen to 101.52 average. Goldfarb concluded that the extensive period of deprivation of the institutionalized babies had had a profoundly detrimental effect on their psychological development with the occurrence of a type of fixation on the most primitive levels of conceptual and emotional behavior. He hypothesized that what happens is that the child's personality becomes so passive that he can no longer assimilate new sources of stimulation and new relationships. He also noted that even after foster home placement the formerly institutionalized child showed an inability to develop close personal relationships with others, although he did develop a capacity for superficial relationships.

In regard to the institutional environment, Yarrow (19) in 1961 pointed out that it is not a simple variable and that qualitative and quantitative differences are apparent, but that there do tend to be certain characteristics common of most institutions handling infants. They appear to foster a certain emotional bluntness and a lack of variation in feeling tone with the result that the infant is not exposed to either strongly negative or strongly positive affective stimulation. The institutions generally fail to provide adequate sensory stimulation, usually being rather drab and colorless. They have a low degree of social stimulation with many different caretakers and a ratio of about one attendant to 10 children with little opportunity for mothering contact. Their learning conditions fail to provide an environment conducive to the acquisition or practice of new skills.

Yarrow noted that the major characteristics associated with institutionalized children are those of general intellectual retardation, language retardation, and social and personality disturbances, especially the capacity to establish and maintain close personal relationships.

Several investigators have called attention to the fact that factor of language retardation is prevalent among infants deprived of sensory and emotional stimulation. Yarrow (19) mentions two or three of these studies in which evidence of language retardation was noted among infants institutionalized during their first few months of life. One of these studies was based on data obtained from careful phonetic analysis of speech sounds. Another noted that

there was little reinforcement by adults of infant vocalization in many institutions and this factor reduced the opportunities for the child to acquire the signal and expressive functions of language. It was felt by this same investigator that this language retardation was a result of inadequate language stimulation, that the lack of motivation for imitative behavior may interact with the insufficient reinforcement of speech sounds in determining this language retardation.

The major deviation reported by the literature, however, is in the area of interpersonal relationships: social apathy with indifference to social attachments and "affect hunger" characterized by incessant seeking of affection (19). The social apathy is described as possessing the following response patterns: (a) lack of social initiative with withdrawal or apathetic response to social approaches, (b) lack of significant attachment or meaningful relationships with institutional caretakers, (c) lack of social discrimination evidenced by failure to give differentiated responses to strangers and to familiar caretakers, and (d) inability to respond discriminately to different kinds of emotional expression.

According to Glaser and Eisenberg (6), it is readily apparent that among the fundamental needs of the infant are those of gentle physical contact, the sounds of pleasant and varying tones of the human voice, experiences in anti-gravity play, visual stimulation from the human environment, and more subtle interpersonal communication. These are hardly less essential than an adequate vitamin and caloric intake. The mother appears to transmit to her offspring emotional warmth and thereby cultivates within him a certain responsiveness and a capacity for close relationships with other humans. She also provides her baby with a tremendous source of stimulation for his intellectual growth and development. These are all experiences which the premature infant in his isolated incubator fails to receive.

In 1952 Howard and Worrell (9), in reporting their findings on 22 prematurely born children (ages 8-19), noted that prematurity appeared to have no lasting effect on the intellectual capacity of these children but that it did appear to have considerable effect on their social and emotional adjustment. In addition to obtaining case histories and psychological interviews on each of these children, objective personality tests (Brown Personality Inventory for Children and Bell Personality Adjustment Inventory for Students) were administered to each child. Of the 21 children administered these tests (one was not given the test because of low intelligence), 12 obtained scores indicating they were below average in their adjustment. As a group their social adjustment appeared to be most affected, with 12 cases described as passive-aggressive. In almost all cases the results were substantiated by the parents. Fourteen of

the children had had feeding disorders during the early months of life, far beyond that expected of the normal child. Five of the 22, because of adjustment difficulties, had been referred to a psychologist at some time in the past.

According to Howard and Worrell, "The emotional instability of the premature infant was contributed to by the physical strain of prematurity, by the overprotective attitudes of the parent, by the poor physical endowment of the premature infant, and perhaps by the rigid type of immediate postnatal care" (9, p. 582).

In the past 10 years there have been numerous studies concerned with human infant stimulation. Blauvelt and McKenna (2) point out that "From direct observation and study of film grew the hypothesis that the newborn has capacity to respond to the stimulation of its mother with activity which orients the baby to its mother, stimulates her, and gives her information about the infant's capacities. The baby was not only manipulated by its mother but responded to her stimulation with active movements toward her, with her, and away from her. The effective movements of orientation, of prehension, and opposition which the newborn appeared to give to specific stimulation often seemed to the observer to control the interrelationship" (2, p. 3).

A study was made by Blauvelt and McKenna of 20 babies and their mothers chosen at random. In order to detect the infants' movements and relate them to stimulation movements, 1400 feet of filmed show-motion study of mother-infant relationships was made during the early postpartum period, during the first feeding period, and during the four or five days of hospital stay when the baby and mother had direct contact with one another. These investigators also observed the periods when the infants were cared for by the nursing staff and then compared the interaction of the baby and mother with that of the baby and nurse. The 20 babies were divided into control and experimental groups, with the latter being given repetitive tactile stimulation near the lips and ears. Film samples were taken at the 2:00 A.M. feeding in the nursery when the second group was gently stimulated for six seconds, as the mother had been stimulating them during the day, while the control group was given no such tactile stimulation. The results disclosed a greater frequency of response (movement at the lips and head movements) as compared with the controls in the experimental group, who had received no such stimulation.

Before leaving this topic of infant sensory and emotional deprivation, we should note that in their attempts to reduce infant mortality hospital procedures have been developed with little regard for the basic psychological needs of the mother and child. David and Appell (4) compared routine nursing care and intensive individualized nursing care of infants hospitalized under one year of age. They noted that the routine nursing care appeared to lead to the

following consequences: (a) isolation leading to a lack of external stimuli; (b) a lack of response to spontaneous behavior, such as crying, smiling, and new achievements; (c) a lack of communication and interaction, leading to a decline or a lack of pleasure or pain provided by or related to humans; and (d) decrease of human stimulation and a lack of or inconsistency of responses to signals coming from the infant. They felt that these factors were reinforced by multiple nursing and by the small amount of time the nurses were able to devote to social contact with the child. With such multiple nursing, the nurse cannot know the infant and his needs or establish a close relationship with him. The intensive nursing care with one or two nurses responsible for the child and his care, however, has also not proved to be satisfactory, because the nurses are not likely to feel love for an unknown baby and they may feel there is no value in stimulating or petting a child if this is not done through love. Again the nurses may try to protect themselves from becoming too much involved with the child from an emotional standpoint.

E. SUMMARY AND CONCLUSIONS

From the studies of Shirley on the prematurity syndrome (16) through the studies on animal and human infant sensory and emotional deprivation during the past 25 years, certain factors emerge.

1. It is apparent that there is a higher incidence of emotional disturbance among premature children than among full term children. The author would hypothesize that the extensiveness and magnitude of this deviant behavior would have a positive correlation with the amount of time the infant had spent in the incubator. The child so isolated for a week or so would be less likely to show emotional disorders in later life than the child spending his first two months of life in incubator isolation.

2. It is quite apparent that longitudinal studies are needed to investigate the factor of reversibility, to examine humans or animals subjected to experimental deprivation or trauma, and to learn more about special populations selected because of some deviation in their cultural norms of mothering, as in the cases of infants separated for adoption, those in multiple mothering situations, and babies swaddled during their early months of life and carried around by their mothers on their backs.

3. Studies should be made of the steroid content of premature babies examined after various lengths of time spent in incubator isolation *versus* the steroid content in full term babies of equivalent ages. These should be longitudinal studies with later analysis of the steroid content in both groups at periodic intervals.

4. Recognition is needed of the fact that sensory deprivation does exist in the environment of the incubated premature infant. The very low frustration tolerance, which Shirley reported, could very well bear a relationship to the infant's early lack of stimulation. Slow motor development could be related to the early lack of visual cues, and language retardation to the lack of human contact. To remedy these conditions it is conceivable that incubators could be so constructed that they would provide a rocking motion for given periods of time. Mother surrogates, similar to those provided infant monkeys, could possibly be made available to these preemies.

5. Last, but not least, perhaps the favorable effects derived from daily periods of fondling and verbally stimulating these infants might more than offset any dangers that could arise from their being physically handled.

The hypothesis supported by this paper does not preclude the evidence that other factors, such as traumatic birth and overprotective parents, may also be responsible for the higher incidence of emotional disturbance in premature infants, as compared with full term babies. This study, however, does point to the need for determining the importance of including incubator isolation as a contributing factor.

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